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Debt and International Finance

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Capital Mobility in Developing Countries

Some Measurement Issues and Empirical Estimates

Peter J. Montiel

It is rare for developing countries to be strongly integrated with world financial markets, but most developing countries must be regarded as financially open, according to new estimates.

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This paper — a product of the Debt and International Finance Division, International Economics Department — is part of a larger effort in the department to study the effects of external financing on developing countries. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Rose Vo, room S8-042, extension 31047 (February 1993, 57 pages).

An economy's financial integration with the outside world (the extent of capital mobility across its borders) is a key determinant of some of its most important macroeconomic properties.

Yet little is known about this characteristic of many developing economies. An important stumbling block in the empirical assessment of financial integration (openness) is the many approaches to measuring it.

Montiel describes and evaluates different tests of capital mobility, surveys existing evidence, and applies four tests of capital mobility — to assess the degree to which the many developing countries tested have achieved integration with world financial markets.

The four tests are the : (1) magnitude of gross capital flows; (2) uncovered interest rate parity; (3) strength of saving-investment correlations; and (4) behavior of domestic consumption over time.

The evidence suggests that most developing countries can be considered to be financially open — in only 18 of the 57 developing countries classified did the data fail to show financial openess — and that many countries may be experiencing an increased degree of integration with world financial markets.

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CAPITAL MOBILITY IN DEVELOPING COUNTRIES: SOME MEASUREMENT ISSUES AND EMPIRICAL ESTIMATES[1]

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I. Introduction

Financial openness exists when residents of one country are able to trade financial assets with residents of another country, i.e., when financial assets are traded goods. The degree of financial openness, however, is a somewhat amorphous concept, not always clearly defined in many applications and difficult to measure. This is unfortunate, because analytical models suggest that the nature of the relationship between domestic and world financial markets (also referred to as the degree of capital mobility) is one of the key characteristics of any economy, serving as a fundamental determinant of many of its most basic macroeconomic properties. These include the scope for promoting investment by stimulating domestic saving, the effectiveness of fiscal and monetary policies in influencing aggregate demand, the implication of a sustained fiscal deficit for the domestic rate of inflation, the incidence of taxes on capital, and the proper setting of controlled interest rates under financial repression, among others.

A weak definition of complete financial openness, which one might refer to as financial integration, can be given as a situation in which the law of one price holds for financial assets -- i.e., domestic and foreign residents trade identical assets at the same price. This definition relies on the absence of barriers to capital movements. However, it permits assets issued in one political jurisdiction to be imperfect substitutes in all private portfolios with otherwise identical assets issued in a different one, as well as differences in preferences between domestic and foreign agents as to the composition of their portfolios. A strong definition would add to this the restriction that identically-defined assets (e.g., a six-month Treasury bill) issued in different political jurisdictions and denominated in different currencies are perfect substitutes in all private portfolios. This would imply that the relative rates of return on such assets would be unaffected by their relative supplies. This assumption would, of course, also eliminate any scope for differences in preferences between domestic and foreign portfolio managers.

Important macroeconomic implications follow from financial integration in the strong sense. Even under the weak definition, however, these implications become increasingly relevant as the degree of substitutability between domestic and foreign assets increases in the portfolios of domestic and foreign agents. This could be termed an increase in the degree of financial integration.

A partial list of the implications of financial integration in the strong sense would include the following:

First, because changes in asset excess supplies and demands in a small economy leave world stocks of particular assets unaffected, such changes would have essentially no influence on the world prices of such assets. Thus, shocks to domestic saving and investment schedules, which affect the domestic flow excess supply and demand for financial assets, would leave the rates of return on such assets confronting domestic agents unchanged[2]. This means in particular that changes in domestic investment would not affect the rates of return on assets available to domestic savers, and that changes in domestic saving would not affect the cost of capital for domestic firms[3]. Thus, increases in domestic investment would not require increases in domestic interest rates in order to elicit the requisite financing. Instead, they would be financed voluntarily by foreign private agents. Similarly, reductions in domestic saving would not discourage capital accumulation in the domestic economy, but would simply decrease the country's rate of accumulation of foreign assets. The implication is that economic growth is not limited by a scarcity of domestic saving. It follows that lending to a developing economy in such circumstances by external public agencies would not add to the total pool of resources available to finance domestic investment, and policy measures to promote saving would not increase domestic investment, but would merely reduce the current account deficit.

Second, the effects of domestic fiscal and monetary policies on aggregate demand also depend on the extent to which the economy is financially integrated with the rest of the world. Under the fixed (or predetermined) exchange rate regime that characterizes most developing countries, perfect financial integration in the strong sense would imply that in a small economy neither fiscal nor monetary policy can influence the terms for domestic borrowing and lending. This means that fiscal policy would fail to generate "financial crowding out", and that the effects of monetary policy would be limited to affecting the composition of private financial portfolios (through capital flows), not the prices of domestic financial assets. From the standpoint of short-run macroeconomic stabilization in developing countries, for example, credit ceilings would be very effective in improving the balance of payments in the short run, but would do so without affecting the level of aggregate

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[2] Notice that, if clams on residents of this country possess different characteristics from claims on foreigners, the economy is no longer "small" in the market for such assets.

[3] This statement needs to be interpreted with care. I mean it to imply only that domestic nominal interest rates are unaffected by such changes. As further discussion will show, real rates may well be affected.

demand and through it the current account balance, the rate of inflation, or the level of real output.

Third, validity of the strong definition would affect an economy's steady-state inflation rate. The revenue that a government can collect from the inflation tax depends on the stock of base money and on the elasticity of base money demand with respect to the rate of inflation. Given the revenue to be raised through the inflation tax, the smaller the stock of base money and the higher its elasticity with respect to the rate of inflation, the higher the steady-state inflation rate. Even under the weak definition of financial integration, domestic agents have more means at their disposal to escape an inflation tax (i.e., by taking capital abroad) than when the economy is financially closed. This is likely to increase the elasticity of base money demand, and thus means that the inflationary consequences of a given fiscal deficit are magnified.

Fourth, the taxation of capital more generally becomes problematic under a situation of high capital mobility, since such taxes can be evaded by taking funds out of the country. With high capital mobility the taxation of capital would leave the domestic economy with a suboptimal capital stock, since owners of capital would require an after-tax rate of return in the domestic economy equal to the pre-tax return available externally.

Finally, the design of interest rate policy in "repressed" economies, in which domestic interest rates are subject to binding legal restrictions, cannot afford to ignore the implications of financial openness. Pending interest rate liberalization, administered interest rates have to be set in some fashion. The pursuit of positive real interest rates in such a setting, based on a closed-economy view which takes the domestic marginal product of capital as the relevant opportunity cost of funds, may easily be frustrated by capital inflows if the economy is sufficiently open.

It is remarkable that, despite these well-known macroeconomic implications, little is actually known about where many developing countries may lie along a spectrum from effective financial autarky to complete financial integration (i.e., financial integration in the strong sense defined above). Although the vast majority of these countries maintain controls on capital movements (see IMF (1990)), their effectiveness is often questioned, and the view is widespread that the mere existence of these controls does not justify treating these economies as financially closed. Yet empirical studies assessing the effective degree of capital mobility in developing countries have not been plentiful. Consequently policy and analytical work on developing-country macroeconomic problems tends to be schizophrenic on this issue, treating these economies sometimes as integrated with world capital markets in the strong sense and at other times as financially autarkic.

This paper will attempt to shed some light on this issue both by examining what is currently known about the degree of financial integration that characterizes several developing countries and by applying the existing empirical techniques suitable to the purpose to attempt to measure this phenomenon in several large samples of such countries. I begin by briefly discussing some conceptual issues associated with the measurement of financial integration in the next section. This is followed by a survey of measurement techniques -- primarily developed for and applied to industrial countries -- in Section III. Because industrial countries are typically considered to be more closely integrated with world capital markets than are most developing countries, Section III will also present an overview of the evidence on financial integration among industrial countries, to serve as a benchmark for the developing-country discussion. Section IV summarizes the results of existing empirical studies of financial integration in developing countries. The paper's empirical work is presented in Section V, where several of the techniques described previously are modified and applied to a large developing-country data set. The findings of this exercise are summarized in a concluding section, which also suggests some directions for further research.

II. Some Conceptual Measurement Issues

Perhaps one reason for the ambiguity that surrounds the empirical degree of financial integration that characterizes developing (and, for that matter, industrial) economies is that no single approach to its measurement has become widely accepted. Among the empirical methods that have been applied, either informally or formally, to measure capital mobility are the magnitude of gross capital flows, the degree to which a variety of arbitrage conditions are satisfied, the scope for sterilization of the effects of reserve movements on the domestic money supply, saving-investment correlations, and, more recently, tests based on the Euler equation for the path of optimal consumption. This section treats some conceptual issues that arise in the application of the first three of these. Because the use of saving-investment correlations as indicators of the degree of capital mobility has aroused a substantial controversy, conceptual issues associated with this measure are best discussed in the context of specific papers, and are thus deferred to Section III. Similarly, since the use of Euler equation restrictions to measure financial integration is rather novel, further discussion of issues associated with this approach is deferred until the approach itself is presented in Section III.

1. The magnitude of capital flows

Many economists have a strongly held belief that industrial countries are, or at least have recently become, highly integrated financially. This belief is at least partly based on the observation that gross financial flows among such countries are

very substantial[4]. The magnitude of gross capital flows in and out of a country indeed indicates the extent to which financial transactions between residents of the country and the rest of the world actually occur, but the size of gross flows is often taken to be an imperfect indicator of the degree of financial integration. The reason is that, while capital flows would indeed be zero under financial autarky, capital flows need not necessarily occur between strongly integrated financial markets, because continuous equalization of the prices of financial assets would remove the incentives for such flows.

Nevertheless, there are at least two reasons to expect that a country enjoying high degree of financial integration with the rest of the world should, on average, experience large gross capital flows. First, in markets that are strongly integrated, the geographic locations of the parties on the two sides of a financial transaction are indeterminate. Thus, borrowing and lending by domestic residents should frequently cross international boundaries.[5] Second, while changes in international rates of return should quickly be reflected in domestic rates under such conditions, preservation of portfolio equilibrium for domestic residents in response to such changes will typically require net capital flows. In the same vein, if the prices of domestic financial assets are determined in world capital markets, domestic financial disturbances will give rise to quantity adjustments in domestic portfolios, and thus to net capital flows.

2. The existence of arbitrage opportunities

The degree of financial integration has typically been assessed not in terms of the size of either gross or net capital flows between jurisdictions, but by the extent to which unexploited arbitrage opportunities exist in domestic capital markets. As indicated previously, weak financial integration between countries A and B means that a given financial asset is traded at the same price by residents of A and B, so that no profitable arbitrage opportunities remain. Thus, the degree of financial integration can in principle be measured as the difference between the prices of identical assets in A and B. Several conceptual problems arise, however, in applying this definition:

a. First, the identification of assets that can be taken to be "identical" in different political jurisdictions is not a trivial

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[4] Golub (1990) cites the examples of Feldstein (1983), p.150, Caprio and Howard (1984), p.4, Obstfeld (1986), p.70, and Penati and Dooley (1984), p.7.

[5] This basic insight formed the basis for an empirical test for capital mobility among industrial countries by Golub (1990) (see Section III).

matter. If an asset can be taken to be defined by the probability distribution of its prospective returns, then the requirement that two assets, to be taken as "identical", offer the same payoff in all states of the world, is a very stringent one. If the distributions of prospective payoffs differ between two assets under consideration, then we would not expect them to be priced so as to yield the same expected rate of return, even in perfectly integrated financial markets, unless agents were risk-neutral. Thus, differences in rates of return between otherwise identical assets issues in different political jurisdictions are consistent with weak financial integration. They may even be consistent with strong financial integration if such assets are perfect subsitutes up to a risk factor -- that is, if return differentials do not depend on relative asset supplies.

b. A wide range of assets will exist in each jurisdiction. If transaction costs differ across assets, then those assets with largest transaction costs may effectively be "nontraded" -- i.e, their domestic prices may be free to vary within a broad band before arbitrage with the rest of the world becomes effective. For such assets, weak financial integration fails. Alternatively, members of a broad class of assets (say, equities) may be more idiosyncratic than assets in another class and thus may be less "identical" to their foreign counterparts. Parity tests involving assets in this class are simply uninformative about the degree of financial integration. Under either of these conditions, arbitrage tests may hold for some assets but not for others.

c. More fundamentally, an operationally meaningful measure of financial integration must be one that focuses on the scope for domestic variables to affect the prices of domestic financial assets, rather than on the existence of profitable arbitrage opportunities per se. These notions are conceptually distinct. To see this, suppose that asset X is traded in jurisdictions A and B, at prices P^A and P^B, and suppose that $P^B > P^A$. If, however, the sale of X in B involves incurring a transaction cost amounting to a fraction t of the value of the asset, then arbitrage will be profitable only if $P^B > P^A(1+t)$. As long as this condition is not met, profitable arbitrage opportunities are absent. Yet, if t is sufficiently large, the range of variation of P^B may never reach this upper bound, implying that the price of X in B is effectively determined by domestic phenomena, even though there are no profitable arbitrage opportunities. In this case, the relevant operational description is that the markets for X in A and B are not integrated, in spite of the absence of unexploited arbitrage profits.

d. A fourth difficulty with parity conditions as estimates of capital mobility can be described by analogy with the implications of tariffs and quotas for goods. Both tariffs and quotas will cause the domestic price of an importable good to exceed its world price, but in the case of the former the domestic price is tied to

the world price by an infinitely elastic supply, whereas in that of the latter the domestic price responds to supply and demand conditions in the home country. Similarly, the failure of arbitrage conditions need not have the policy implications associated with imperfect capital mobility if there is a constant differential between domestic and external interest rates arising, for example, from taxation. In general, the policy implications to be drawn from the failure of parity conditions depend on the source of the failure.[6]

Why might arbitrage fail between "identical" assets in different political jurisdictions? Among the reasons that have been cited are the following:

i. Transactions costs in asset trading that inhibit arbitrage.
ii. Information costs, coupled with asymmetric information between domestic and foreign agents.
iii. Legal barriers to asset trading (capital controls), both those already in place and (separately) prospective future barriers.
iv. Asymmetric risks or taxes borne by domestic and foreign investors.

All of these represent obstacles to financial integration in the weak sense.

III. Empirical Approaches to the Measurement of Financial Integration

1. The magnitude of gross flows

As already mentioned, many economists' intuition that capital has become highly mobile among industrial countries in recent years is partly based on the observation that gross capital flows among countries have become very large. Golub (1990) attempted to formalize this intuition into an explicit test for the degree of capital mobility. He reasoned that, if capital were perfectly mobile, the country origin of borrowers and lenders should not matter. This means that the share of total asset issues in country A purchased by residents of that country should equal the country's share in world lending. Golub tested this proposition for 12 OECD countries during the 70s and 80s, and found that domestic creditors took up a much larger fraction of each country's asset issues than would be predicted based on that country's share in total OECD lending. He interpreted this finding of a substantial "domestic asset preference" as contradicting the view that capital is highly mobile among OECD countries, though he did find that even by this measure capital mobility has been increasing among OECD countries in recent years. In the terminology used here, Golub's findings

[6] This point is due to Obstfeld (1990).

constitute evidence against strong financial integration, but are consistent with the weaker version.

2. Parity conditions

a. Simple interest parity

This condition states that, under perfect financial integration, the nominal return on an asset denominated in the domestic currency should be equal to the return on an otherwise identical asset denominated in foreign currency when exchange risk is eliminated through forward cover:

$$(1+i) = (1+i^*) f/s \qquad (1)$$

where i is the interest rate on the asset denominated in domestic currency, i^* is the interest rate on the asset denominated in foreign currency, s is the spot exchange rate (price of foreign currency in terms of domestic currency), and f is the forward rate that applies to the same maturity as i and i^*. Operationally, assets are identified as identical by choosing assets with the same legal definition in the same political jurisdiction. This condition seems to hold quite closely among industrial countries. It has been tested by comparing rates of return on Eurocurrency deposits, with the classic reference being Frenkel and Levich (1975). As several authors have noted, however (see, for example, Frankel (1986)), because the assets being compared must be within the same jurisdiction, this condition is not particularly useful in assessing the degree of financial integration among different countries.

b. Covered interest parity

The difference between the interest rate paid by a domestic asset and the "covered" rate paid by an asset which is identical to it except for the currency of denomination and the political jurisdiction where the debtor is located is referred to as the "country," or "political" premium. Tests of covered interest parity (CIP) are in effect tests for the existence of such a premium. Until recently, the evidence (see, for example, Dooley and Isard (1980)) was consistent with a nonnegligible country premium among industrial countries. Data for the decade of the eighties, however, seems to suggest that this premium may have disappeared, at least for a large number of industrial countries (see Obstfeld 1986), and Frankel (1991)).

c. Uncovered interest parity

In the absence of forward cover, the domestic-currency return on an asset denominated in foreign currency becomes random, even abstracting away from other sources of uncertainty, because of the possibility of an exchange-rate change. Uncovered interest parity (UIP) is the assertion that investors care only about the first moment of their subjective distributions of future returns on the risky (foreign) asset. If they do, then in the absence of barriers to capital movements such as those listed in Section II, the expected returns on the domestic and foreign assets should be equalized:

$$(1+i) = (1+i^*)\,E(s_{+1})/s \qquad (2)$$

where E is the expectations operator. Sufficient (but not necessary) conditions for UIP are the validity of CIP and $f=E(s_{+1})$ (the forward rate is an unbiased predictor of the future spot rate). This can be shown by writing (2) as:

$$(1+i) = (1+i^*)\,(f/s)\,(E(s_{+1})/f) \qquad (3)$$

Equation (1) and $f=E(s_{+1})$ imply (3), yet (3) can hold without implying either (1) or $f=E(s_{+1})$. If CIP holds, the condition $f=E(s_{+1})$ becomes necessary and sufficient for UIP.

Testing UIP requires making an ancillary assumption about how the unobservable subjective expectations of future exchange rate movements are formed. With rational expectations, $E(s_{+1})$ becomes the expectation of the true distribution of s_{+1}, conditioned on the available information. Under these circumstances, $s=E(s)+e$, where the prediction error e must be a mean-zero random variable. The contents of the information set used to form the expectation E(s) depend on the efficiency of the foreign exchange market. If the market is "weakly" efficient, the information set must contain at least the past prediction errors (i.e., lagged values of e). Under these circumstances, e must be serially uncorrelated. UIP can thus be tested by running the regression:

$$s = a + bf_{-1} + e \qquad (4)$$

and testing the joint hypothesis that a=0, b=1, and e is white noise. Alternatively, without postulating CIP (or in the absence

of data on f), UIP can be tested directly by taking logs of the lagged version of (2) and estimating:

$$\ln(s/s_{-1}) = a + b(i_{-1}-i^*_{-1}) + e \qquad (5)$$

and again testing whether a=0, b=1, and e is serially uncorrelated. That is, under UIP, rational expectations, and "weak" market efficiency, the interest differential should be an unbiased, efficient predictor of future exchange rate depreciation.

An important pitfall in conducting either of these tests is the "peso problem" (Krasker (1980)). When the exchange rate is fixed, but market participants perceive a finite probability of a discrete devaluation which does not in fact take place during the sample period, the observed forward rate will systematically exceed the future spot rate even if it truly reflects the expected future spot rate. In this case, the null hypothesis (of unbiasedness) will tend to be rejected, even when true, more often than the investigator intends.[7]

The evidence for industrial countries is that UIP does not hold. Many researchers (see, for example, Cumby and Obstfeld (1984)) have verified this finding. One interpretation is that there is a non-constant (i.e., time-varying) risk premium. Such a premium could be consistent with strong financial integration, as long as the assets are perfect substitutes after the premium is taken into account. Alternatively, systematic differences in rates of return on otherwise similar assets denominated in different currencies and issued in different political jurisdictions could respond to changes in the relative supplies of such assets. This "imperfect substitutes" case is inconsistent with strong financial integration, and is discussed further in subsection 3 below.

d. Real interest parity

This condition requires that the expected domestic real rate of return (measured in terms of domestic goods) equal the expected foreign rate of return (measured in terms of foreign goods):

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[7] Strictly speaking, the difficulty here is not bias, but a small sample problem. The problem is that the sampling distribution for the hypothesis a=0, b=1 converges very slowly to its limiting distribution under the conditions postulated, so statistical tests based on the asymptotic distribution result in Type I error.

$$r=(1+i)P/E(P_{+1})=r^{*}=(1+i^{*})P^{*}/E(P^{*}_{+1}) \qquad (6)$$

which can be rewritten as:

$$(1+i)=[(1+i^{*})E(s_{+1})/s]\,[(sP^{*}/P)/(E(s_{+1})E(P^{*}_{+1})/E(P_{+1}))] \qquad (7)$$

Thus, sufficient conditions for RIP are UIP and ex ante relative PPP. Both of these fail tend to fail among industrial countries (see Mishkin (1984), and Frankel (1991)) so, not surprisingly, RIP has been widely rejected among these countries as well. Failure of ex ante RIP among seven OECD countries is found by Mishkin (1984), using quarterly data for the period 1967-1979. Similarly, Cumby and Obstfeld (1984) use both monthly and quarterly data from January 1976 to September 1981 to reject ex ante RIP among six OECD countries (except between the US and UK). The same result was found by Mark (1985) for bilateral tests between the Us and five OECD countries from 1973:5 to 1982:2. More recently, Caramazza et. al. (1986), using monthly data over the period 1973-85, reject the equality of ex ante RIP for all pairs tested among seven OECD countries except Canada and the United States.

3. Tests of the effectiveness of sterilization

As suggested previously, one of the important policy implications of strong financial integration under fixed exchange rates is that monetary policy becomes powerless to affect aggregate demand. Essentially this is because the domestic monetary authorities lose control over the money supply. Changes in the domestic assets of the central bank (e.g., through open market operations) intended to influence the money stock would create incipient changes in the rates of return on domestic assets which could not in fact materialize, since they would quickly be arbitraged away through foreign borrowing and lending. In the process, the central bank's net foreign assets would change by an amount equal in magnitude but opposite in sign to the triggering change in its domestic assets, leaving the stock of high-powered money, and the total money supply, unchanged. This result would not hold if domestic and foreign interest-bearing assets were imperfect substitutes, because then changes in the relative supplies of such assets in private portfolios would affect their relative rates of return. In this case, changes in the domestic assets of central banks could, by changing the composition of outside assets in private portfolios, alter domestic interest rates and achieve changes in the domestic money stock.

For industrial countries operating flexible exchange rates, this issue arises in the context of the effectiveness of sterilized

intervention. Given that UIP fails to hold, the issue is whether this constitutes a rejection of strong financial integration -- i.e. whether deviations from UIP can be affected by changes in relative stocks of outside interest-bearing assets denominated in different currencies, such as would be achieved through sterilized intervention. If so, this would support a portfolio-balance model in which assets denominated in different currencies and issued in different jurisdictions are imperfect substitutes, rather than close substitutes with time-varying risk premia.

Explaining this premium remains an unresolved issue, but the weight of the evidence suggests that it cannot easily be accounted for by relative stocks of outside assets denominated in different currencies. Thus strong financial integration cannot easily be rejected by the data (see, for example, Rogoff (1984)).

4. Saving-investment correlations (Feldstein-Horioka)

For a small country producing a single good that is perfectly integrated with world goods markets as well as integrated in the strong sense with world financial markets, a change in domestic saving should have no effect on the rates of return faced by domestic agents, since these are determined in the world capital market, and accordingly should not affect domestic investment via this route. Based on this insight, Feldstein and Horioka (1980) (hereafter FH) proposed assessing the degree of financial integration in the world economy by measuring the extent to which national saving and investment rates are correlated. Using annual data for 21 OECD countries over the period 1960-74, they estimated several cross-section OLS regressions of the form:

$$(I/Y)_i = a + b(S/Y)_i + e \qquad (8)$$

where (I/Y) is the ratio of gross domestic investment to GNP, and (S/Y) is the ratio of national saving to GNP, taken as the mean of 5-year periods as well as the full 15-year period. FH argued that, under the null hypothesis of perfect financial integration, b should be zero for small countries, whereas for large countries b should approximate the country's share of the world capital stock, since any increment in domestic saving should be invested without regard to national boundaries. Their estimates of b, however, were closely centered around 0.9. This finding was robust to the inclusion of a quadratic term for (S/Y), to the inclusion of the population growth rate as an additional explanatory variable, to a linear specification for b that permitted it to be a function of "openness" variables such as the share of trade in GDP or the size of the economy, as well as to the use of instrumental variables (taking the benefits/earnings replacement ratio of social security programs, the proportion of retirees to the population 20-65 years of age, and the ratio of younger dependents to the working age

population as instruments). This evidence was interpreted by FH as consistent with a low degree of financial integration among OECD countries during this period.

The findings of FH have been confirmed in broad terms by many other researchers, using different samples and different empirical techniques. Frankel (1985), for example, regressed time series observations of decade averages of I/Y on those of S/Y for the US, using data extending into the nineteenth century and instruments consisting of the share of military spending in GNP as well as a measure of the age distribution of the population, and derived an estimate of 0.96 for b. Bayoumi (1990) looked at ten industrial countries over the period 1965-86, estimating b in cross section for the full period as well as several subperiods, and also found high values of b, with no pattern over time, whether the estimates were conducted in levels or first differences.

At best, other investigators have been able, in certain samples, to detect values of b statistically different from the autarky value of unity, but the point estimates of b continue to be relatively high, even among industrial countries with few legal barriers to capital movements. Caprio and Howard (1984), for example, using the national income accounting identity CA = S-I (CA denotes the current account of the balance of payments), regressed:

$$d(CA/Y)_i/d(S/Y)_i=\mu+e \qquad (9)$$

(where d is the first difference operator) for a sample of 23 OECD countries using data drawn from the period 1963-81, but using the business cycle as the unit of observation (i.e., annual data were averaged from cycle trough to cycle trough). With complete autarky, mu should be zero, whereas with perfect financial integration the value of mu should be unity. Their point estimate of 0.45 was estimated precisely enough to permit them to reject both extremes.[8] Consistent with this estimate, their estimated value for b in a firt-differenced version of the FH equation was 0.63 which, though statistically different from unity and lower than that derived by FH, remains surprisingly high.

Earlier, Sachs (1982) had appeared to obtain results somewhat less in accordance with those of FH. Sachs estimated the equation:

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[8] However, when Caprio and Howard estimated the corresponding version of equation (9) for investment, i.e., d(CA/Y)/d(I/Y)=mu+e, rather than the perfect integration value of -1 for mu their point estimate was -0.08, not significantly different from the autarky value of zero.

$$d(CA/Y)_i = c + f\,d(I/Y)_i + e \qquad (10)$$

for a cross-section of OECD countries. Under perfect capital mobility, f should be -1, and in fact Sachs' point estimate was -0.65, seemingly contradicting the finding of almost complete financial autarky for these countries in FH. Dooley and Penati (1984), however, found that, whereas regressions of (I/Y) on (S/Y) as in FH tended to be stable across various subperiods, those of (CA/Y) on (I/Y) did not. They proved to be highly sensitive to the inclusion of data from the decade of the seventies and of certain outliers among the countries in their sample. Beyond this, Dooley and Penati addressed some of the received wisdom about the increasing financial integration among industrial countries during the postwar years. They argued that, if industrial countries are indeed becoming more integrated financially, them we should observe:

a. That the cross-section correlation between I/Y and S/Y was lower in the decade of the seventies than that of the fifties.

b. That the correlation in cross-section between CA/Y and I/Y was small in the decade of the fifties, and negative in the seventies.

c.. That the correlation between d(I/Y) and d(S/Y) should be small, while that between d(CA/Y) and d(I/Y) should be negative.

The found that all of these predictions were rejected by the data.

The view that b has not fallen over time among industrial countries, however, has proven to be somewhat less robust than the finding that the value of b has been relatively high on average. Both Obstfeld (1986) and Vos (1987) found that b fell after 1973, contrary to the the results cited above. Obstfeld used time series regressions based on quarterly observations of changes in (I/Y) and (S/Y) for several OECD countries, while the estimates of Vos were based on both cross-section and pooled cross section-time series results. Vos obtained an estimate of approximately 0.8 for b before 1973, 0.55 for 1973-79, and 0.49 for 1980-84. Note that, even in the most recent period used in both of these studies, the estimate of b remains far from its hypothesized full-integration value of zero. These results are consistent with those of Feldstein and Bachetta (1991), who found b declining from 0.91 during the decade of the sixties to 0.61 during 1980-86 for a cross-section sample of 23 OECD countries. The most extreme evidence of a decline in b was provided by Frankel (1991), albeit only for the US. Using cyclically-adjusted annual data and instrumental variable estimation, he found that, while b was approximately unity during 1930-79, it became statistically indistinguishable from zero during 1980-86.

Although the empirical findings of FH have thus proven

difficult to refute, their interpretation of the evidence as suggesting that industrial countries are much less integrated financially than commonly believed has not been generally accepted. The response to the FH findings has broadly divided into two camps:

a. Some analysts (Harberger (1980), Caprio and Howard (1984), Murphy (1984), Tobin (1983), Summers (1988), Obstfeld (1986), Tesar (1988) and Bayoumi (1990)) interpret the correlations as simply uninformative about the degree of capital mobility. Within this group, one subset (Harberger, Caprio and Howard, Murphy, and Bayoumi) accepts on the basis of other evidence that financial integration is indeed high among OECD countries (or at least has become so recently), and interprets saving-investment correlations as arising from a variety of other causes. A second subset (Tobin) questions the degree of financial integration that industrial countries have actually achieved, but again on the basis of independent evidence.

b. Another group (Penati and Dooley (1984), Frankel (1985), Dooley, Frankel, and Mathieson (1987), Feldstein and Bacchetta (1991)) accepts the FH correlations at face value as evidence that domestic saving and investment can indeed have direct effects on each other, as postulated by FH. Again this group divides into two subsets. Penati and Dooley, Dooley, Frankel, and Mathieson, and Feldstein and Bacchetta, interpret the evidence as suggesting that financial integration is indeed limited among OECD countries, and develop explanations that reconcile this view with the evidence for a high degree of capital mobility derived from other sources. More recently, Frankel (1986), (1991), (1992), has adopted the view that the FH evidence reflects imperfect integration in <u>goods markets</u>, rather than financial markets.

The first group takes the position that, though zero capital mobility implies that (I/Y) and (S/Y) would be highly correlated, the converse is not true -- i.e., national saving and investment rates could be highly correlated even if world financial markets are perfectly integrated in the sense defined previously. Essentially, this is because national saving is endogenous in the FH equation - i.e., (S/Y) is correlated with the error term. The source of this correlation differs between time series and cross-section applications. In time series, the correlation could arise because:

i. Both I/Y and S/Y are functions of the state of the business cycle - i.e., of a third variable Y/YBAR. In particular, both I/Y and S/Y are known to be procyclical. On analytical grounds, there is reason to believe that temporary real shocks, such as to the productivity of domestic capital and labor, to the prices of imported inputs, or to world real interest rates, would move domestic saving and investment in the same direction (see Obstfeld (1986)).

ii. Governments could respond to incipient current account deficits (increases of I/Y relative to S/Y) by contracting fiscal policy to achieve a current account target. Taking national saving as the sum of private and public saving, this makes national saving endogenous through its public component.

iii. The country in question could loom large in world financial markets. Shocks to national saving could thus affect world interest rates and through them domestic investment. Murphy (1984), in particular, shows that the high value of b in FH can be attributed to the inclusion of three large countries (the US, Japan, and the UK). When these are removed from the sample, the value of b falls to approximately 0.6.

In a cross-section context neither i nor iii are relevant. However, national saving and investment rates may both be functions of the country's long-run growth rate (see Obstfeld (1986)). The dependence of national saving on the rate of growth is a direct and familiar implication of life-cycle consumption theory, while steady-state growth implies:

$$(I/Y) = (n + \text{delta})\ (K/Y).$$

If (K/Y) depends on the real interest rate, which is common to all countries, then (I/Y) is an increasing function of n.

The key difference between the alternative interpretations of the Feldstein-Horioka results turns on whether phenomena such as these are taken as full explanations for the observed correlations between saving and investment ratios, leaving nothing to be explained by the direct effects of either variable on the other. The second group takes the position that saving-investment correlations have been too large and too robust to be accounted for in any of the ways described above. In part this view is based on refinements of the estimation technique to take some of these phenomena into account. Frankel (1986) addressed the large-country issue in a time-series study for the US by expressing saving and investment rates as deviations from rest-of-world rates, reasoning that under perfect capital mobility a drop in US saving may indeed crowd out investment worldwide, but there would be no reason for it to do so differentially in the US. Nevertheless, a high correlation between US saving and investment rates expressed in this form remained during 1970-85.

In several papers, Frankel develops an argument that reconciles perfect financial integration as measured by tests of CIP and an interpretation of saving-investment correlations as reflecting, at least in part, bidirectional causation between the two variables, as in FH, rather than merely the common influence of some third domestic factor or external feedback through large-country effects, as suggested above. The argument relies crucially on the observation that the validity of CIP is compatible with the

failure of RIP. As we have seen, this can be achieved if either UIP or ex ante relative PPP fail. Since saving and investment both depend on the domestic real interest rate, and since the domestic real interest rate can vary independently of the world rate in spite of CIP, then shocks to either saving or investment that alter the domestic real interest rate will cause each variable to affect the other. Suppose that UIP holds, but that a temporary exogenous increase in saving results in a temporary real exchange rate depreciation (i.e., ex ante relative PPP fails, because the real exchange rate will be expected to appreciate in the future). Since, under UIP, this would cause the expected domestic real interest rate to fall, investment would rise, resulting in a positive correlation between saving and investment. Even a permanent saving shock could have this effect, if the initial real exchange rate depreciation overshot its long-run level.

To summarize, the use of saving-investment correlations to draw inferences about the degree of financial integration is problematic, because there are at least two ways that saving and investment could be correlated even if financial markets were well integrated, in the sense that UIP held exactly:

i. First, I/Y and S/Y could be correlated even if RIP also held, because they are both endogenous variables which respond to movements in common factors, both in time series and cross section.

ii. Second, shocks that are specific to saving or investment would also give rise to a positive correlation between the two variables, even under UIP, precisely because RIP does not hold.

To the extent that saving-investment correlations arise from this second source, however, they may nevertheless provide evidence of the extent to which exogenous shifts in domestic saving or investment can induce changes in the other variable. As indicated in Section I, this is one of the key policy issues motivating a concern with the degree of financial integration.

5. Euler equation tests

Recently, Obstfeld (1986) proposed an alternative to both arbitrage conditions and saving-investment correlations as measures of the degree of financial integration among countries. This test is based on the Euler equation that characterizes the optimal intertemporal behavior of consumption, and amounts to an attempt to detect whether residents of different political jurisdictions have access to the same risk-free asset.

For domestic residents, the Euler equation for optimal intertemporal consumption plans can be written as:

$$E_t(P_t/P_{t+1}) x \beta U'(c_{t+1}) / U'(c_t) = 1/(1+i_t) \qquad (11)$$

for each period t. Here c denotes real per capita consumption, beta is a subjective discount factor, and i is the riskless interest rate. The corresponding condition for foreigners is:

$$E_t(S_t P_t^*/S_{t+1} P_{t+1}^*) x \beta^* U^{*\prime}(c_{t+1}^*) / U^{*\prime}(c_t^*) = 1/(1+i_t) \qquad (12)$$

where S is the nominal exchange rate and asterisks denote foreign variables, but the same risk-free rate i applies. Equations (11) and (12) imply that the expected marginal rates of substitution between current and future units of the domestic currency must be equal for foreign and domestic residents. To test this, Obstfeld assumes that domestic and foreign residents have the same utility function and that period utility takes the constant relative risk-aversion form:

$$U(c_t) = \frac{1}{1-a} c_t^{1-a} \qquad (13)$$

Under these circumstances, one can define the variable:

$$n_t = \left(\frac{c_t}{c_{t+1}}\right)^a \left(\frac{P_t}{P_{t+1}}\right) - \left(\frac{c_t^*}{c_{t+1}^*}\right)^a \left(\frac{S_t P_t^*}{S_{t+1} P_{t+1}^*}\right) \qquad (14)$$

and the equality of the expected marginal rates of substitution becomes:

$$E_t n_t = 0 \qquad (15)$$

In other words, n_t should be expected to be zero based on information available before it is observed -- i.e., no variable contained in the information set available prior to time t should help to predict the time-t value of n.

Obstfeld (1986) used a grid of values for the parameter a to construct quarterly time series for n_t over the period 1962:II to 1985:II using Japan and Germany as the foreign countries and the US as the domestic country. He tested for perfect capital mobility

between each of these two pairs of countries by testing whether past values of n_t (which would of course be in the time-t information set) helped predict its current value, using tests of exclusion restrictions. He found that, though the null hypothesis of zero coefficients on past n_t's could be rejected over the whole sample (a finding which is inconsistent with perfect financial integration during the period as a whole), it could not be rejected at conventional significant levels between the US and Japan after 1973:I, suggesting that the two countries became highly integrated financially after that time.

This test posseses several attractive features compared to those that have considered above. Unlike arbitrage tests of CIP or UIP, it does not require comparisons between rates of return on what might be dissimilar assets, and unlike tests of RIP the null of strong financial integration would not be rejected due to a failure of ex ante relative PPP. Furthermore, unlike FH tests it is not vulnerable to indirect sources of saving-investment correlations. Moreover, it focuses specifically on what is meant by weak financial integration -- i.e., that residents in different political jurisdictions be able to trade the same asset on the same terms. The disadvantage of this test, of course, is that restrictive assumptions are equired to implement it -- i.e., the underlying consumption model must be correct for both countries, and cross-country differences in utility functions must be negligible. Because the test therefore embodies multiple hypotheses, rejections may be difficult to interpret. Finally, as in the case of arbitrage tests, statistically significant rejections may not be economically important if n_t is small on average.

IV. Empirical tests of capital mobility for developing countries

As indicated in the introduction, developing countries tend to be treated, in both policy and analytical work, as either closed to capital flows (except perhaps for nonmarket-based lending from official sources or bank lending to their public sectors) or as completely open, with domestic interest rates bound by UIP to the levels prevailing internationally. The motivation for the former is that the vast majority of developing countries maintain formal legal restrictions on capital movements. According to the IMF's 1991 Annual Report on Exchange Arrangements and Exchange Restrictions, out of 136 member developing countries, 113 were classified as maintaining formal restrictions on capital account transactions. Yet, in spite of such controls, various types of evidence suggest that many developing countries are far from financially closed. This section reviews the available evidence, which takes the form of indications of the size of gross flows, tests of interest parity conditions, tests of the effectiveness of sterilization, and some limited evidence on saving-investment correlations.

1. The magnitude of gross flows

To the extent that the size of capital flows is indicative of the degree of financial integration, evidence on past episodes of substantial capital movements in and out of developing countries can be brought to bear on the issue. In Latin America, for example, the recent past has witnessed several episodes during which capital flows in both directions have been sufficiently large as to become the focus of policy concern. These include the period of substantial external debt accumulation during 1974-82, the large short-term capital inflows associated with the Southern Cone stabilization programs in 1978-82, the gross private capital outflows associated with the "capital flight" phenomenon which afflicted several Latin American countries during the first half of the eighties and, more recently, a widespread resurgence of capital inflows, primarily to the private sector, during 1990-91 (see Calvo, Leiderman, and Reinhart (1991)).

Except for the most recent capital-inflow episode, each of these events has generated a substantial literature which documents the extent to which these economies have been financially linked to the world capital market. One way to summarize the implications of these capital-flow episodes is to measure, at a point in time, the gross stocks of financial claims between developing countries and external financial markets to which they have given rise. For the group of fifteen heavily-indebted developing countries, the stock of gross external debt as of 1988 amounted to about 75 percent of GDP.[9] For the same year, Rojas-Suarez (1990) estimated that the total external claims of a very similar group of developing countries, overwhelmingly acquired in the form of private capital flight, amounted to about two-thirds of their external debt, or about half of GDP. Rojas-Suarez found a high correlation between the stock of flight capital and a measure of default risk, corroborating the findings of others (e.g., Cuddington (1986) and Dooley (1986)) who have linked private capital outflows from developing countries to portfolio considerations. Thus, the gross-flow evidence, which unfortunately is available only for the major indebted developing countries, indicates that these countries have exhibited a substantial amount of at least <u>de facto</u> financial openness.

2. Tests of interest parity conditions

a. Covered and uncovered nominal interest parity

Lizondo (1983) conducted tests of both CIP and UIP for Mexico, using monthly data over the period 1977-80. Based on standard tests, he was able to reject the joint hypothesis of UIP and rational expectations, whether using the one-month forward rate or

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[9] See Montiel (1992). The countries in the group consist of

the one-month interest differential as the predictor of the future spot rate. However, because of the "peso problem" he did not interpret these rejections as necesarily invalidating UIP for Mexico during this period. In testing CIP, Lizondo followed the methodology of Frenkel and Levich (1975), computing neutral bands around CIP based on estimated transactions costs and tabulating the number of observations of domestic interest rates lying outside those bands during the period. He found that percentage to be extremely high, ranging from 75 percent for one-month Treasury bills to 96 percent for three-month time deposits. Lizondo was able to account for this rejection of CIP in terms of legal regulations consisting of prior deposit restrictions on forward transactions and taxes on foreign exchange capital gains. The upshot is that, though unexploited profit opportunities were apparently absent, domestic rates could depart substantially from their CIP counterparts in Mexico during this period. More recently, however, Khor and Rojas-Suarez (1991) found that, during 1987 to 1990, yields on dollar-indexed Mexican government bonds were cointegrated with yields to maturity on Mexican public external debt traded in the secondary market. This suggests that Mexico's degree of integration with external financial markets may have increased in recent years.

Results similar to those of Lizondo for Mexico were obtained by Phylaktis (1988) for Argentina during 1971-84. Using the methodology of Dooley and Isard (1980), she was able to account for 83 percent of the quarterly variance of the differential between the 3-month domestic deposit rate and its UIP counterpart (using the US as the reference country) through the use of standard portfolio variables and step dummies for capital controls. The implication is that, while foreign financial variables influenced domestic interest rates in Argentina during this period (i.e., the economy was financially open), foreign and domestic assets were imperfect substitutes (strong financial integration did not hold) and certain types of capital controls proved to be effective in increasing the differential between foreign and domestic rates of return.

In a departure from the standard methodology, Edwards and Khan (1985) postulated that the actual domestic interest rate in a developing country could be expressed as a weighted average of the external (UIP) rate and the domestic interest rate that would prevail in a financially closed economy. The latter was expressed as a function of the excess money supply and the expected rate of inflation. When the determinants of the closed-economy interest rate are substituted into the weighted average expression for the domestic interest rate, the result is a reduced-form interest "parity" condition which expresses the domestic interest rate as a function not only of the external rate, but also of domestic monetary conditions. This approach, then, in effect uses domestic monetary variables to explain the "risk premium". Estimating this reduced form makes it possible to detect any influence of the

domestic monetary variables on the domestic interest rate. If UIP holds continuously, such variables should have no explanatory power in the reduced form. By contrast, if the economy is completely closed, the UIP variable should not enter. Edwards and Khan estimated this model using quarterly data for Colombia (1968-82) and Singapore (1976-83). They found that for Colombia both external and domestic variables mattered, making this economy "semi-open", while for Singapore only the UIP foreign interest rate helped to explain the domestic interest rate, as would have been expected under strong financial integration.

A serious difficulty inhibiting tests of interest parity for large groups of developing countries is that many such countries engage in "financial repression" -- i.e., the practice of subjecting interest rates in the formal financial system to binding legal constraints. Thus published interest rates in such countries do not tend to apply to assets with market-determined rates of return. Though "informal" credit markets tend to arise outside the controlled financial system, with interest rates that are free to respond to the forces of supply and demand, data on such rates is rarely available. In these circumstances, inferences about the extent to which market-clearing interest rates in the domestic financial system are affected by world financial conditions become difficult to draw.

Recently, Haque and Montiel (1991) adapted the methodology of Edwards and Khan to allow testing of UIP under such circumstances. Retaining the assumption that the (unoberved) domestic market-clearing interest rate is a stable weighted average of the autarky rate and the UIP rate, they were able to estimate the relevant weights by substituting the resulting expression for the market-clearing rate into the money-demand function and estimating the resulting nonlinear function of observable variables. In this estimation, the weight corresponding to the UIP emerges as the coefficient of this variable in the estimate of the money-demand function. This coefficient, which is bounded between zero and one, indicates the degree of financial integration, with values approaching unity being indicative of perfect financial integration. Haque and Montiel's results for 15 developing countries during the period 1969-87 are reported in Table 1. In 10 of the 15 cases reported, the weight of the UIP rate could not be statistically distinguished from the perfect capital mobility value of unity. For four countries in the sample (Brazil, Jordan, Malta, and Turkey) an intermediate degree of financial integration prevailed during this period. The financial autarky value of zero failed to be rejected in only one case (that of India). Overall, these results are consistent with a substantial degree of integration with external financial markets for the countries considered.

Table 1 Haque-Montiel Estimates of Capital Mobility Parameter for 15 Developing Countries

Brazil	0.723a	Morocco	0.877b
Guatemala	0.708b	Philippines	0.577b
India	0.158c	Sri Lanka	0.638b
Indonesia	0.865b	Tunisia	0.833b
Jordan	0.500a	Turkey	0.525a
Kenya	0.600b	Uruguay	0.890b
Malaysia	0.638b	Zambia	1.019b
Malta	0.411a		

a: Significantly different from both zero and one.
b: Significantly different from zero, but not from one.
b: Significantly different from one, but not from zero.

The Edwards-Khan and Haque-Montiel methodology was applied to Korea and Taiwan by Reisen and Yeches (1991) and to Thailand by Robinson (1991). The former used quarterly data for the decade of the eighties and direct observations on the curb market interest rate in these countries, finding a weight of 0.594 on the UIP rate in Korea and 0.353 in Taiwan during this period, in each case distinguishable from zero and unity. This places these countries among the intermediate group above. Kalman filter tests suggested that the degree of integration peaked for Korea during the period 1981-84, but was relatively constant for Taiwan over the decade. Robinson's findings for Thailand were similar, with a weight for the UIP of 0.590 during 1978-90.

Tests for changes in the degree of financial integration due to domestic financial liberalization in Pacific Basin countries were also conducted by Faruqee (1991). Using monthly observations on money-market interest rates, the latter constructed time series on the differentials between such rates in Korea, Malaysia, Singapore and Thailand and the three-month Japanese yen LIBOR rate during the period 1978:9 to 1990:12. Mean differentials were large and positive for Korea and Thailand, but not for Singapore and Malaysia. In all four countries, both the mean and variance of the differentials decreased in the second half of the sample period. Time series modeling of the differentials revealed a statistically significant positive constant for Korea and Thailand only, and the Korean differentials exhibited a significant negative trend over the period. Mean-reverting behavior was weak in all four countries. Because the residuals from the ARMA estimates exhibited smaller variability in the second half of the period, Faruqee reestimated the time series models using an autoregressive

conditional heteroskedasticity (ARCH) approach and found that the variance of shocks to the ARMA residuals declined monotonically for Singapore, but not for the remaining countries. In all cases, however, the variance of shocks was smaller in 1990 than it had been in 1980, leading Faruqee to conclude that the degree of financial integration increased in these countries over the decade of the eighties.

3. Tests of monetary autonomy

In the developing-country context, tests of the effectiveness of sterilization have focused on estimates of the "offset coefficient" that relates changes in the stock of domestic assets of the central bank to changes in reserve flows. As already indicated (see Section III), under strong financial integration, this coefficient should have a value of -1, since any expansion of the domestic assets of the central bank will give rise to an offsetting capital outflow, leaving the stock of money unchanged and implying a loss of monetary autonomy. The early literature on this subject, following the monetary approach to the balance of payments, invariably confirmed an offset coefficient of -1 and a loss of monetary autonomy. However, this work proved beset by a number of methodological problems which undermined the interpretation of this finding as suggestive of high capital mobility (see Kreinin and Officer (1978)).

More recent work by Cumby and Obstfeld (1984), using a structural model of the Mexican financial sector, found that, during the decade of the seventies, strong financial integration did not hold between Mexico and the United States. Slow portfolio adjustment and imperfect asset substitutability permitted Mexico to retain at least some short-run monetary autonomy during this period. Within a quarter, only 30-50 percent of a domestic credit increase was found to leak abroad via capital outflows. Rennhack and Modino (1988) applied the Cumby-Obstfeld model to Colombia, using quarterly data drawn from 1975 to 1985, with very similar results: the within-quarter offset coefficient amounted to about 40 percent, and monetary autonomy was at least partially retained even in the long run. By contrast, the same approach yielded very different results in the case of Malaysia during 1978-81, where Bini (1982) found a 70 percent offset to changes in the stock of domestic credit within the first month.

An implication of the retention of monetary autonomy is, of course, that policy-induced changes in domestic financial aggregates will affect macroeconomic variables other than the capital account. Thus the detection of domestic macroeconomic effects arising from monetary policy shocks under fixed exchange rates provides an indirect confirmation of the retention of at least some degree of monetary autonomy. While this means that any evidence that monetary policy can affect domestic macroeconomic

variables is of potential relevance to the issue of financial integration, it is obviously impossible to review all such evidence here. One way to narrow the field is to restrict attention to work which explicitly tests whether monetary policy can influence the domestic interest rate against the alternative that the domestic interest rate is determined by UIP. Boschen and Newman (1989), for example, found that real interest rates in Argentina were significantly affected by unanticipated monetary growth during the period 1976:7 to 1982:6, with little evidence of a role for foreign interest rates.

A recent approach to the detection of monetary autonomy which does not rely on structural estimates of offset coefficients is based on causality tests. In the absence of monetary autonomy under fixed exchange rates (i.e., under perfect financial integration), domestic financial aggregates such as money or credit should not Granger-cause movements in nominal income. Montiel (1989) and Dowla and Chowdhury (1991) have tested this hypothesis for a number of developing countries. The former used annual data for twelve countries during 1962-86, and relied on VARs including broad money, domestic credit, international reserves, and nominal income. Money or credit was found to Granger-cause nominal income in Bolivia, Chile, Ghana, Indonesia, Mexico, Morocco, Peru, and Sierra Leone, but not in India, Pakistan, Turkey, or Sudan. Dowla and Chowdhury used quarterly data for thirteen countries over sample periods of varying length during 1957-89. They found that some domestic financial aggregate (M1, M2, or domestic credit) Granger-caused domestic real output in Greece, Cote d'Ivoire, Jordan, Korea, Malawi, Mexico, Singapore, and Tunisia, but not in Bangladesh, India, Israel, Malaysia, and Pakistan.

4. Saving-investment correlations

Most of the literature that followed Feldstein and Horioka focused on industrial countries. However, several investigators (Dooley, Frenkel, and Mathieson (1986), Summers (1988)) included a number of developing countries in their cross-section samples and considered the effect of including such countries on their results. Surprisingly, these authors concurred in finding that the inclusion of developing countries reduced the strength of the saving-investment correlation in their samples. This was unexpected, since these countries were perceived ex ante as less integrated with world capital markets than industrial countries.

The only study to date which has focused specifically on developing countries is Wong (1988), who looked at a cross-section sample of 45 developing countries using annual data averaged over the period 1975-81. Wong's results were consistent with those cited above. For his full sample, the saving ratio has no statistically significant effect on the investment ratio. When five extreme observations were excluded, b took on a value of about 0.6, statistically different from both the autarky value of unity

and the perfect integration value of zero, but still substantially below what other investigators had found for industrial countries. Wong separated his sample into two groups based on the import-GDP ratio as an inverse proxy for the size of the traded goods sector and found that the group with the lower import-GDP ratio exhibited a higher value of b, consistent with the Frenkel (1985) interpretation of the FH correlation emphasizing lack of integration in goods markets. Finally, Wong produced indirect evidence both for and against the use of saving-investment correlations as indices of capital mobility. On the one hand, he found that independently constructed indices of the severity of capital controls affected the coefficient b in the direction to be expected if b were a true indicator of the degree of financial integration. On the other hand, he found that, though the average size of current account imbalances increased for this group of countries between 1966-72 and 1975-81, the parameter b proved to be stable across the two periods.

5. Summary

The existing evidence for developing countries suggests that few, if any, of these countries can be considered to be financially closed. Even in the case of India, where the Haque-Montiel methodology is unable to reject the null hypothesis of financial autarky, some contrary evidence exists in the form of a similar inability to reject the proposition that the major financial aggregates do not Granger-cause real output. Elsewhere the evidence of financial openness is stronger.

For countries such as Argentina, Colombia, Indonesia, Korea, Mexico, Morocco, and Thailand, tests of arbitrage relationships indicate that external (UIP) interest rates play an important, but not necessarily exclusive, role in affecting domestic interest rates, suggesting that, while these economies should be regarded as financially open, the strong form of financial integration has not held. Several other types of evidence are consistent with this conclusion for these countries. For example, gross flows have been large (in the form of both debt and capital flight) in Argentina, Colombia, and Mexico, yet independent evidence of the retention of monetary autonomy is available for all three countries. Similarly, though arbitrage tests cannot rule out strong financial integration in Indonesia and Morocco, domestic financial aggregates are found to Granger-cause domestic activity in both countries. Brazil, Jordan, Malta, and Turkey may also be in this group.

At the other extreme, the evidence suggests that Guatemala, Malaysia, and Singapore may represent instances of financial integration in the strong sense. Arbitrage tests are consistent with this conclusion, and tests of monetary autonomy do not provide contrary evidence for either Guatemala or Malaysia.

For the majority of developing countries, however, formal

tests of financial integration have either not been conducted or only very limited evidence is available. Saving-investment correlations and consumption-based tests have simply not made their way to the developing-country literature. Thus, the bits and pieces of evidence on financial integration that exist for developing countries do not lend themselves to drawing systematic conclusions for any but a very few countries. Existing tests have been applied in limited fashion, over disparate periods of time, and use very different methodologies. To gain a more comprehensive perspective, it is desirable to unify this piecemeal evidence by applying the existing approaches to the measurement of financial integration in a uniform fashion to large samples of developing countries over similar periods of time. This is undertaken in the next section.

V. Some Tests for Developing Countries

In this section, I apply four of the tests described previously to measure capital mobility during the decade of the eighties in a large number of individual developing countries. The samples in each case are comprised of the largest groups of developing countries for which the relevant data could be acquired conveniently. The four tests consist of measures of gross capital flows, saving-investment correlations, tests of arbitrage conditions, and Euler equation tests. In view of the discussion in Section III, I would consider these to have been listed, at least conceptually, in order of increasing reliability as indicators of the degree of financial integration in the sense defined here. All of these tests have shortcomings of varying degrees of severity, which I will discuss below. The hope is that, by using a battery of tests, a coherent picture may emerge for some countries, though each test individually may provide a noisy indicator. Some problems, however, apply to more than one test. Particularly important for the last three regression-based tests, the degree of capital mobility is treated as constant over the period of estimation. Thus, recent changes in financial openness cannot hope to be captured by measures of this sort.

1. Gross capital flows

By analogy with measures of commercial openness derived by expressing the sum (or the average) of exports and imports as a ratio to GDP, the first measure to be constructed consists of the value of capital transactions in the balance of payments (average of inflows and outflows) expressed as a fraction of GDP. This has not only the conceptual problem associated with measures of gross flows described in Section II, but also some very substantial empirical problems.

In particular, the measure could be very sensitive to the level of aggregation at which it is constructed --i.e., to the

degree of "netting out" present in published balance of payments data. To the extent that published data are reported on a net basis, of course, the size of gross flows will be understated, and differences among countries in the size of such flows underlying the net data will distort cross-country comparisons. This would be a problem, for example, where annual balance of payments data record changes in gross stocks during the course of the year, rather than all transactions that took place during the year. Thus, for example, if a short term capital outflow is reversed during the year, a capital-outflow measure which relied on the change in the stock of short-term liabilities during the course of the year would record neither the initial outflow nor the subsequent inflow, and would thus underreport the volume of transactions between domestic and foreign residents during the year. Nevertheless, this measure may be worth examining as the only available indicator of the volume of capital-account transactions for developing countries. To the extent that reported capital-account transactions in the balance of payments reflect the true underlying volume of transactions, this indicator has the dual virtues that it serves as a (crude) check on prior beliefs both across countries and over time, as well as that it can be constructed year by year.

Table 2 reports the values of this indicator for 88 developing countries. In column 2 of this table the ratio of the mean value of capital inflows and outflows to GDP is averaged over the period 1980-89 (the last year for which data were available for a large group of countries).[10] An interesting contrast emerges in this table between capital and commercial flows. The standard measure of commercial openness (the ratio of the average value of exports and imports of goods and services to GDP) is reported in column 1 of Table 2. As is evident from a casual comparison of the first two columns, commercial flows are much larger for almost all countries in this group than are reported capital flows[11]. The average values of these variables for the group as a whole appear at the end of the list of countries. Commercial flows amounted to almost 45 percent of GDP for the group as a whole, while capital flows represented only 12 percent of GDP. By this measure, then, developing countries would seem to be much less open financially than they are commercially. However, this conclusion is not

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[10] The data were taken from the IMF's Balance of Payments Yearbook. The sum of all inflows and outflows, using the finest classification available to avoid netting, was divided by two and converted into domestic currency using the World Bank's ATLAS exchange rate to smooth the effects of changes in exchange rates. This was then divided by GDP as reported in the Bank's World Tables.

[11] The sole exception is Nicaragua, a country which was undergoing a civil war for much of this period.

Table 2 Ratios of Trade and Gross Capital Flows to GDP

(In percent)

	Trade Ratio 80-89	Capital Flow Ratio 80-89	Capital Flow Ratio 84-86	Capital Flow Ratio 87-89
Algeria	24.94	7.34	6.22	9.01
Antigua	99.72	20.21	19.09	19.89
Bahamas, The	70.84	3.84	3.54	3.00
Bahrain	115.94	11.18	9.53	12.09
Bangladesh	13.41	3.79	3.77	3.57
Barbados	62.48	8.08	7.38	6.58
Bolivia	29.46	16.67	18.10	11.26
Botswana	88.73	10.02	11.02	9.07
Brazil	11.75	7.77	9.60	6.94
Burkina Faso	21.74	4.45	4.92	5.01
Cape Verde	44.15	6.38	7.83	4.20
Central African Rep.	29.73	6.31	8.37	3.41
Chad	25.02	5.46	6.31	8.80
Chile	32.03	16.70	24.18	13.63
Colombia	17.88	5.89	7.55	6.25
Congo	59.48	31.64	32.43	32.80
Costa Rica	41.29	20.28	17.03	14.86
Cote d'Ivoire	40.56	15.07	14.15	17.58
Cyprus	58.85	9.59	9.74	10.10
Dominica	54.25	8.85	8.04	13.12
Dominican Rep.	31.21	6.63	5.72	5.55
Ecuador	28.07	19.73	20.49	20.32
Egypt, Arab Rep.	33.16	8.55	7.52	7.62
El Salvador	28.92	7.67	7.31	5.46
Ethiopia	17.34	4.10	4.44	5.02
Fiji	51.18	8.10	6.69	8.56
Gabon	54.63	15.93	16.25	21.05
Gambia, The	61.39	17.02	19.78	17.45
Ghana	20.55	6.74	7.98	7.11
Grenada	68.46	10.14	7.90	14.47
Guatemala	18.80	6.66	6.93	8.28
Guinea-Bissau	28.82	18.07	21.59	31.36
Haiti	22.25	3.63	3.80	3.12
Honduras	34.01	10.06	9.59	10.87
India	8.49	1.50	1.51	2.31
Indonesia	25.99	4.96	4.45	7.15
Israel	45.94	12.90	11.86	10.39
Jamaica	60.91	24.39	33.61	22.81
Kenya	29.16	5.89	5.50	6.51
Korea, Rep. of	38.57	6.42	5.27	4.25
Kuwait	68.68	19.47	20.07	19.98

Table 2 Ratios of Trade and Gross Capital Flows to GDP (Cont'd.)

(in percent)

	Trade Ratio 80-89	Capital Flow Ratio 80-89	Capital Flow Ratio 84-86	Capital Flow Ratio 87-89
Lesotho	131.66	15.87	13.09	17.32
Libya	41.53	5.38	2.32	10.01
Madagascar	19.22	10.76	9.63	14.45
Malaysia	62.43	9.10	10.10	8.88
Mali	28.59	6.73	7.57	8.25
Mauritania	61.36	17.91	19.33	16.83
Mauritius	59.00	7.04	6.78	7.38
Mexico	17.40	9.01	9.05	6.98
Morocco	28.09	7.23	6.86	5.56
Nicaragua	29.76	29.48	23.61	38.03
Niger	26.29	8.77	9.44	7.18
Nigeria	21.37	9.22	6.65	20.18
Pakistan	18.45	3.58	3.46	4.58
Panama	154.22	140.16	78.85	186.53
Papua New Guinea	51.33	12.99	11.06	9.70
Paraguay	25.35	8.48	8.29	11.00
Philippines	28.51	7.94	9.77	6.09
Rwanda	16.49	3.34	3.38	3.42
Sao Tome and Princip	51.79	23.60	33.49	14.25
St. Kitts and Nevis	75.00	15.03	12.99	18.79
St. Lucia	75.10	11.81	8.43	11.64
St. Vincent	79.43	6.77	5.88	9.25
Saudi Arabia	58.02	12.08	11.09	10.54
Senegal	39.88	11.36	10.83	9.36
Seychelles	74.92	11.75	13.55	11.00
Sierra Leone	21.08	12.05	13.95	12.35
Singapore	191.48	21.15	22.99	23.07
Somalia	41.09	12.38	11.77	16.33
South Africa	30.22	2.88	3.25	1.71
Sri Lanka	35.56	9.15	9.14	10.37
Sudan	15.06	4.28	3.32	3.98
Suriname	48.20	4.21	3.11	6.97
Swaziland	99.46	13.74	13.48	19.17
Syrian Arab Rep.	23.94	6.19	5.45	8.26
Tanzania	20.06	9.57	13.47	12.70
Thailand	31.48	6.20	6.45	6.04
Togo	53.65	17.40	16.20	14.12
Tonga	53.54	4.62	3.97	3.13
Trinidad and Tobago	40.97	7.67	6.33	10.79
Tunisia	42.59	9.05	8.65	9.25
Turkey	20.71	6.36	7.24	7.01
Uganda	22.18	10.03	8.02	12.03
Uruguay	25.04	8.04	4.57	9.65
Venezuela	26.29	6.48	3.36	9.04
Western Samoa	47.24	5.67	5.42	4.06
Zaire	25.30	9.29	8.11	12.28
Zambia	41.64	18.38	20.94	23.88
Average	44.89	11.90	11.27	13.12

warranted, since the "netting out" problem described above does not apply to commercial transactions, imlpying that the two measures are not directly comparable.

It is interesting to note that little movement in the direction of increased financial openness is evident over time in these data. For most countries, the capital flow ratio exhibits little change between 1984-86 (column 3) and 1987-89 (column 4). The slight increase in the average between these periods for the group as a whole is largely accounted for by the extreme values reached in Panama during the latter period.

The distribution of capital flow ratios for this group of countries is skewed to the right. Eight countries exhibit ratios in excess of 20 percent, 13 countries are in the range below 20 but above 15 percent, 15 countries are below 15 but above 10 percent, 39 countries are found between 10 and 5 percent, and the remaining 13 countries have ratios below 5 percent. Panama and India are at the extremes of the distribution, with capital flows substantially exceeding GDP in the former and amounting to only about 1 1/2 percent of GDP in the latter. This figure for India is consistent with the finding in the previous section that tests of parity conditions could not rule out financial autarky for this country. The group of countries that registered capital flows in excess of a fifth of their GDP included, in addition to Panama, Antigua, the Congo, Costa Rica, Jamaica, Nicaragua, Sao Tome and Principe, as well as Singapore. Again, the inclusion of the latter in this group is consistent with evidence of a high degree of financial integration for this country in existing studies. Neither Malaysia nor Guatemala, however, which also appeared highly integrated with external financial markets on the basis of existing evidence, scored very highly on this particular index of openness. Both of these countries were in the modal range of 5-10 percent. Interestingly, all of the countries taken to be in the intermediate group in the previous section were also found in this range. If these countries are used as a benchmark and the gross capital flow ratio is used as an indicator, this implies that the overwhelming majority of countries in the sample exhibit at least an intermediate degree of integration with external financial markets. The exceptions are the Bahamas, Bangladesh, Burkina Faso, Haiti, India, Indonesia, Pakistan, Rwanda, South Africa, Sudan, Suriname, and Tonga, where gross flows represented less than five percent of GDP.

2. Saving-investment correlations

In spite of the interpretation problems posed by saving-investment correlations a la Feldstein-Horioka as indices of capital mobility (see Section III), it is useful to examine what information such correlations can provide about capital mobility in developing countries. Where the data are available, such

correlations can be calculated at low cost, and the coefficient b derived from time series estimates of Feldstein-Horioka regressions at least represents a straightforward index of the degree of capital mobility that can in principle be compared across countries.[12]

The first column of Table 3 presents the estimates of b derived from standard Feldstein-Horioka regressions in levels (i.e., as in equation (8)), using ordinary least squares, for a sample of 62 developing countries for which data on national saving and gross domestic investment were available in the World Bank's World Tables during the period 1970-1990[13]. Of the 62 countries in the sample, 10 produced such imprecise estimates of b that they could not be statistically distinguished from either zero or unity at the 95 percent confidence level. Of the remaining 52, 14 yielded estimates of b that could not be statistically distinguished from the closed-economy value of unity, yet were different from zero at the 95 percent confidence level. By contrast, 12 countries were at the other extreme -- i.e., with b not different from zero but distinguishable from one at the 95 percent confidence level. The remaining 26 countries were in an intermediate position. Using the small industrial-country value of 0.6 derived by Murphy (1984) as well as by Caprio and Howard (see Section III) as a benchmark, we find that 19 of the countries in this last group produced point estimates of b below what might be considered a "representative" industrial-country value. Thus, consistent with what has been found by others, the FH methodology applied to this group of countries appears to suggest a surprisingly high degree of capital mobility in the majority of developing countries in this sample.

Recall, moreover, that one explanation for the high degree of correlation between national saving and investment rates in industrial countries has been the endogeneity of saving in OLS regressions. Thus the estimates above may be biased upward. To address this potential problem, the FH regressions were reestimated with instrumental variables, using the share of government consumption in GNP and (one minus) the population dependency ratio as instruments for the saving rate. The results are reported in column 4 of Table 3. Because data on the instruments were not available for some countries, the sample size in this case dropped to 56. Surprisingly, the instrumental-variable correction did not

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[12] As indicated in Section IV, time series-based FH regressions have not previously been reported for large samples of developing countries.

[13] Though the focus here is on the decade of the eighties, restricting the sample period to this decade would have left too few degrees of freedom in this case, which requires regressions based on annual time series.

Table 3 Feldstein-Horioka Regressions for Developing Countries: Coefficient of the Saving Rate

	OLS			Inst. Variables		
	Levels	Changes	EC	Levels	Changes	EC
Algeria	0.68a	-0.14b	-0.01b	0.89a	-0.22b	-0.13b
Argentina	1.08a	0.21c	0.22b	0.88a	0.34b	0.49
Benin	0.04	0.58c	0.53c	0.07	0.51c	0.06
Brazil	0.58c	0.13c	0.12c	0.27b	0.39	0.21b
Burkina Faso	0.69a	0.58c	0.37	n.a.	n.a.	n.a.
Burundi	0.87a	0.54c	0.69c	1.52c	0.25	0.64
Cameroon	0.42c	0.37c	0.32c	0.42c	0.30b	0.43c
Cent. African Rep.	0.71	0.19b	0.32c	1.24a	0.39	-0.30
Chile	0.51c	0.63c	0.52c	0.40b	0.30	0.65a
Colombia	0.07	0.07	-0.05	0.03b	0.14b	-0.01b
Congo	0.87a	0.24	0.33	0.49c	0.10b	0.29
Costa Rica	-0.26	0.09	0.09	0.57a	0.45	0.93
Cote d'Ivoire	0.36	0.13	0.15	0.06b	-1.26	-1.22
Dominican Rep.	0.81c	0.22c	0.31c	0.51c	0.07	0.41
Ecuador	0.42c	-0.23	-0.17	0.73a	-0.13b	0.22b
Egypt	0.43c	0.44c	0.54c	1.07a	0.73	0.60
El Salvador	0.29c	0.06b	0.22b	0.50c	0.26b	0.29b
Fiji	2.15a	0.34b	0.36c	-0.34	0.63	1.01
Gabon	0.05b	0.38c	0.35c	0.50c	0.14	0.19b
Gambia	0b	-0.18b	-0.2b	-1.44	-0.53b	-0.69c
Ghana	1.07a	0.18b	0.51c	1.25a	1.06	4.43
Guatemala	0.23	0.40	0.34	0.54c	0.22	-0.09
Haiti	0.15b	0.04b	0.08b	-0.39	0.16b	0.00b
Honduras	0.53c	0.69a	0.59a	0.80a	1.18a	0.60
India	1.02a	0.99a	0.97a	1.45a	0.43	0.24
Indonesia	0.82a	0.23b	0.20b	1.37a	-0.04b	0.23
Israel	-0.18	-0.01b	-0.12b	n.a.	n.a.	n.a.
Jamaica	0.28b	0.09b	0.16b	n.a.	n.a.	n.a.
Kenya	0.24	0.37c	0.12b	-0.49b	-0.05b	-0.49b
Korea	0.35c	0.15b	-0.37b	0.31c	0.50	0.07b
Lesotho	-0.29b	0.17b	0.20b	-0.89b	-0.12b	-0.16
Madagascar	0.20b	-0.02b	-0.01b	-11.10c	0.04	0.54
Malawi	0.79a	0.65a	0.39b	0.59	-0.36	-0.65
Malaysia	0.24	0.11c	-0.06b	0.41	0.08b	0.08b
Mali	0.22c	0.82a	0.11c	-0.35b	0.11b	0.09b
Malta	0.62c	0.65c	0.80c	-0.10b	-0.68b	-0.61c
Mauritania	-0.06b	0.40c	0.50c	-0.43b	-0.46	0.86
Mauritius	0.66	0.37c	0.50c	0.43b	0.35	0.11
Mexico	0.28c	0.05b	0.39c	0.20b	0.01b	0.03b
Morocco	-0.13b	0.37c	-0.05b	0.48	0.36b	0.35b
Nepal	1.09a	0.80a	0.64c	0.94a	0.38c	0.51c
Niger	0.98a	-0.09b	0.84a	0.69a	0.91a	0.74a
Nigeria	0.64a	0.07b	-0.01b	1.20a	0.65a	0.74a
Pakistan	0.44c	0.73c	0.11b	1.07a	0.04b	0.10b
Paraguay	0.52c	-0.05b	-0.03b	0.60	-0.66b	0.56b
Peru	0.43c	0.24b	0.19b	0.53	0.18b	0.30b
Philippines	1.16c	0.56c	0.45c	1.04a	0.49c	0.67c
Rwanda	0.47c	0.02b	0.13b	1.05a	-0.41	0.37
Senegal	0.36c	0.19c	0.18c	0.56c	-0.11b	-0.04b
Sierra Leone	0b	0.21b	0.2c	-0.10b	-0.02b	-0.01b
Singapore	0.08b	0.08b	0.17b	n.a.	n.a.	n.a.
Sri Lanka	0.73	-0.08b	0.01b	n.a.	n.a.	n.a.
Thailand	0.72c	0.62c	0.55c	-0.53	-0.11	-0.30
Togo	0.17b	-0.08b	-0.05b	0.33	0.06b	0.22b
Trinidad	0.22c	-0.03b	-0.04b	n.a.	n.a.	n.a.
Tunisia	0.77c	0.15b	0.19b	1.29a	0.44	0.48c
Turkey	0.47c	0.41c	0.41c	1.01a	0.55	0.45
Uganda	0.07b	-0.05b	0.02b	0.33c	0.48	0.32b
Uruguay	1.1a	0.20b	0.28b	0.58	0.14b	0.20b
Venezuela	0.70c	-0.2[illegible]	-0.22b	1.68c	1.53a	1.59a
Zambia	0.54c	-0.23b	0.01b	0.81a	0.42	0.71
Zimbabwe	0.56c	0.64c	0.66c	1.72	0.36b	0.40b

a= Different from zero at the 5 percent level
b= Different from one at the 5 percent level
c= Different from both zero and one at the 5 percent level

seem to have the effect of reducing the estimated coefficient on the saving rate appreciably. Thirteen countries yielded estimates of b that were too imprecise to be useful in this case, and the remainder were approximately evenly split between those with b not statistically different from unity (19 countries) and those with estimated values either not different from zero (12 countries) or below the benchmark of 0.6 (9 countries).[14]

Several of the studies that have addressed the Feldstein-Horioka results in the industrial country context have estimated regressions of investment on saving in first differences. While these papers have not always provided a rationale for doing so, a strong case can be made that this is indeed the appropriate procedure (see below). In any case, to the extent that the reasoning underlying the test is valid, the results should hold as well in first differences, and re-running the regressions in this form at the very least provides a test of robustness. Estimates of b using first-difference regressions are reported in columns (2) (for the OLS regressions) and (5) (for the IV regressions) of Table 3. Casual inspection of these columns in comparison with the results of the regressions in levels, suggests that the FH regressions do not pass the robustness test. Estimates of b change sharply for individual countries in the majority of cases. If b is taken as an indicator of a country's degree of financial integration with the outside world during this period of time, it would appear that several countries could be classified as effectively closed or almost perfectly integrated financially depending on whether the estimate of b was derived from a regression estimated in levels or first differences.

A possible reason for this result is that the regressions based on levels of the variables may be producing spurious results. The valid reason to estimate in first differences rather than levels is that the saving and investment ratios entering the FH regressions may be nonstationary variables. If they are, and they are not cointegrated, then a regression in levels may lead to spurious correlation (see Granger and Newbold (1974)). Indeed, this may provide an alternative interpretation for the high correlations between domestic saving and investment observed in industrial-country data. If each of these variables possesses a single unit root, then first-differencing would render them stationary and regressions based on changes would not exhibit the spurious correlation problem. As it happens, the null hypothesis of a single unit root cannot be rejected for any of the saving and

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[14] I exclude Burundi, Madagascar, and Venezuela from any of these categories because the point estimates of b for each of them was estimated with high confidence to be outside the theoretically prescribed range of zero to unity.

investment ratios in this data set.[15] Thus the regressions based on levels of the variables are inappropriate in this case.

However, the first-difference regressions may themselves be misspecified. If the saving and investment ratios for individual countries are cointegrated, then the relationship between them can be given an error-correction representation (Engle and Granger (1987)). In this case, estimating in first differences has the effect of omitting the error-correction term from the regression, leaving it misspecified. In the case at hand, the null hypothesis of no cointegration could be rejected only for a minority of countries.[16] While on the face of it this would suggest that proceeding with the first difference regressions is acceptable, this conclusion may be unwarranted for two reasons: First, the cointegration tests have very low power, particularly in samples this small (21 observations) and against alternatives involving a high degree of serial correlation.[17] Second and more importantly, theoretical considerations suggest that saving and investment should be cointegrated, even under perfect capital mobility. The reason is that the current account provides the resources with which a country repays its external creditors. Solvency thus imposes a constraint which prevents deviations between national saving and investment from becoming permanent. Since gaps between saving and investment must eventually be reversed for the country to remain solvent, we should expect that sufficient observations would show these two series to be cointegrated.[18]

Thus, I interpret the failure to reject cointegration in the majority of cases as a small sample problem and adopt an error-correction (EC) specification of the FH regression. To conserve degrees of freedom given the small number of observations, I choose the simplest such specification, consisting of a regression of the

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[15] This is based on augmented Dickey-Fuller tests. The results are available upon request.

[16] Again, the results are available upon request.

[17] When testing for cointegration between saving and investment, one is effectively looking at the time series properties of the current account. For a number of reasons, ranging from the balance of payments stages hypothesis to serial correlation in foreign economic activity and world commodity prices, one would expect developing-country current account ratios to exhibit a substantial degree of serial correlation.

[18] A country's intertemporal budget constraint implies that the present value of the cumulative trade balance should equal its current net international indebtedness. This in turn implies that the present value of the cumulative current account should be zero. For this to be so, the current account must be stationary.

change in the investment ratio on a constant, the lagged residual from the cointegrating regression, and the change in the saving ratio. the coefficient of the latter is the estimate of b. It is reported in column (3) of Table 3 for the OLS version and in column (6) for the IV version. Focusing on the latter, the respecification makes a substantial difference to both the qualitative and quantitative nature of the results. Of the 56 countries in the sample, only four (Chile, Niger, Nigeria, and Venezuela) produced estimates of b insignificantly different from the closed-economy value of unity, while only one (the Philippines) yielded an estimate that was both precisely estimated and greater than the benchmark value of 0.6. Of the remaining countries, 25 had estimates of b that were either indistinguishable from zero (22 cases) or below the benchmark.[19]

Taken at face value, these results would appear to suggest that the developing countries in this sample have exhibited a substantial amount of capital mobility -- more so, in fact, than this methodology is able to detect for industrial countries with more highly developed capital markets and fewer explicit barriers to capital movements. However, alternative interpretations can be provided for this finding. Notice that, unlike the situation for industrial countries, the problem here is to explain why saving-investment correlations are so <u>low</u>, not so high. An easy, but rather destructive explanation, is that the data for these countries is simply very poor. Developing-country macro data are commonly held to be much worse than their industrial-country counterparts, and since saving estimates tend to be calculated as residuals, saving ratios may be particularly poor approximations to their true values[20]. Errors-in-variables problems here would indeed tend to bias estimates of b in a downward direction. What little can be done about this --i.e., using instrumental variables to minimize the negative correlation between the contaminated variable and the error term -- has already been done in column (6).

A different (but complementary) interpretation relies on a rethinking of the FH test in the developing-country context. The rationale for the FH test is that, with zero capital mobility, domestic investment must be financed with national saving, whereas when capital mobility is high, domestic investment can be independent of national saving because external creditors will supply the requisite financing on market terms. In many developing countries, however, domestic investment can differ from national saving even if capital is perfectly immobile in the sense defined

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[19] Nonsense results (i.e., b estimated precisely, but outside the unit interval) were produced by two countries in this case.

[20] For a more extensive discussion of measurement problems associated with developing-country saving data, see Aghevli et. al. (1989).

here -- i.e., even if markets do not arbitrage at all between domestic and foreign financial instruments. The reason is that such countries have access to a nonnegligible quantity of external financing on nonmarket terms. Bilateral and multilateral external assistance is indeed often intended precisely to supplement national saving as a source of financing for investment. Yet, such nonmarket aid flows do not represent financial integration in the sense described previously, because they do not represent an endogenous response of the market to arbitrage opportunities among financial assets. Most importantly, such nonmarket flows do not have the policy implications associated above with the presence of a high degree of capital mobility.

What would happen to measured saving-investment correlations in the presence of nonmarket flows? Intuitively, since such flows break the link between national saving and domestic investment, the measured correlation between them will be weakened. More formally, consider a country which is financially closed, but which receives foreign nonmarket assistance. To the extent that such flows are devoted to investment, they belong in the FH regression, since domestic investment now depends not just on national saving, but also on the magnitude of aid inflows. Omitting the latter would leave the FH regression misspecified. Standard specification error analysis suggests that the coefficient of the saving rate would still correctly capture the independent effect of national saving on domestic investment -- and thus serve its intended role as an indicator of the degree of capital mobiltiy -- as long as all of the aid inflow was absorbed by investment, because in this case national saving and aid would be independent variables, and their effects on investment could be independently measured. However, if the receipt of aid affects the saving rate, then the omission of the aid variable from the regression would bias the coefficient of the saving rate, since the latter would pick up some of the efeects of the former on domestic investment. Suppose, in particular, that aid receipts are only partially invested, the rest being consumed. Then the receipt of aid would <u>lower</u> the measured saving rate. If aid flows are omitted from the FH regression in this case, the coefficient of the saving ratio would be biased <u>downward</u> as a measure of the independent effect of national saving on domestic investment, because the omitted variable, which has a positive coefficient in the "true" regression, would be negatively correlated with the included variable (i.e., an increase in the saving rate would often reflect a reduction in aid receipts, and the latter would lower investment).

To correct for this problem, the regressions underlying the results reported in Table 3 were reestimated taking aid flows into account. This was done by measuring such flows as net financing (disbursements minus repayments) received from multilateral and bilateral creditors, and expressing these as a share of GNP. In addition, the change in net foreign assets of the central bank in each of these countries was treated in the same manner as the

receipt of nonmarket financing, essentially because this represents an additional source for financing saving-investment imbalances in developing countries without relying on private capital markets. Since most of the countries in the sample maintained a fixed exchange rate during the sample period, the contribution of reserve flows is potentially large, and indeed accounted for several percentage points of GNP in a number of instances in this sample. To conserve degrees of freedom, the reestimation was performed under the restriction that each of the financing sources had the same effect on domestic investment. In other words, the saving ratio was replaced by the ratio of the sum of national saving, net nonmarket inflows, and reserve depletion to GNP.

The results of the reestimation are reported in Table 4. The error-correction instrumental variables estimates contained in column 6 are the preferred results, since they simultaneously address all of the econometric issues raised in this section. Using these estimates, for 9 of the 56 countries in the sample the null hypothesis of b=1 could not be rejected at the 95 percent level of confidence. This group includes India, Nigeria, the Philippines, and Venezuela, as well as smaller countries such as Ghana, Honduras, Kenya, and Niger. Malawi is also in this group, although the point estimate of 0.53 is below the industrial-country benchmark value of 0.6. With the exception of Honduras, all of these countries were found in the modal or below-modal group for the gross-flow index calculated in the previous subsection[21]. At the other extreme are 23 countries with b indistinguishable from zero statistically, as well as 9 countries in which b can be distinguished from both zero and unity, but with point estimates of b below 0.6. Among countries discussed in the previous section, Brazil, Mexico, and Morocco, all of which were taken as exhibiting financial openness, but not necessarily strong financial integration, are in this group. Not surprisingly, so is Malaysia. In this case, 13 countries produced estimates of b too imprecise to be useful.

Overall, taken at face value, the FH methodology indicates that developing countries tend to differ substantially among themselves with respect to their degree of financial integration with world capital markets, but that for a substantial majority of such countries (32 out of the 43 relevant cases here) the data are consistent with a substantial degree of financial openness. Only about a fifth of the countries in the sample produced estimates of b consistent with financial autarky. What cannot be determined, of course, is the extent to which these results truly reflect a high degree of financial integration, rather than just poor data. The broad consistency of the results with previous estimates as well as with the gross-flow index suggests that they may have some

[21] Honduras, with a gross-flow ratio of 10.06 percent, barely escaped the modal group (see Table 2).

Table 4 Modified Feldstein-Horioka Regressions for Developing Countries: Coefficient of the Saving Rate

	OLS			Inst. Variables		
	Levels	Changes	EC	Levels	Changes	EC
Algeria	0.96a	0.08b	0.27b	1.12a	0.01b	0.21
Argentina	0.63c	0.22c	0.24c	1.07a	0.36c	0.57
Benin	0.31c	0.31c	0.33c	0.37c	0.32c	0.33c
Brazil	0.19c	0.17c	0.17c	0.31b	0.32b	0.15b
Burundi	0.81c	0.61c	0.71c	0.86a	0.68a	0.64c
Cameroon	0.33c	0.39c	0.33c	0.38c	0.39c	0.38c
Cent. African Rep.	0.69c	0.23c	0.35c	1.00a	0.00b	0.64
Chile	0.41c	0.58c	0.52c	0.03b	0.34	0.35b
Colombia	0.36c	0.41c	0.43c	0.35c	0.46c	0.54c
Congo	0.51c	0.37c	0.49c	0.54c	0.35b	0.66
Costa Rica	0.47c	0.28c	0.32c	0.60c	0.36b	0.41c
Cote d'Ivoire	0.77a	0.02b	0.11b	0.16	-2.32	-2.88
Dominican Rep.	0.41c	0.24c	0.34c	0.24b	0.02b	0.18b
Ecuador	0.43c	0.19b	0.19b	0.60a	0.25b	0.34b
Egypt	0.50c	0.40c	0.41c	0.61c	0.40c	0.42c
El Salvador	0.45c	0.04b	0.15b	0.47c	0.12b	0.21b
Fiji	0.51c	0.17b	0.23b	0.25b	0.08b	0.10b
Gabon	0.67a	0.50c	0.51c	0.68c	0.42	0.50
Gambia	0.52c	0.01b	0.13b	0.76a	0.01b	0.37b
Ghana	0.60a	0.37b	0.61c	1.02a	0'90	1.23a
Guatemala	0.72c	0.41c	0.68a	0.45c	0.30b	0.42b
Haiti	0.24c	0.08b	0.12b	0.61a	0.44b	0.48
Honduras	0.72c	0.73a	0.76a	0.78a	0.68a	0.75a
India	1.07a	0.92a	0.93a	1.35a	0.72a	0.75a
Indonesia	1.01a	0.37c	0.42c	1.21a	0.61	0.71
Kenya	0.55c	0.83a	0.77c	0.20b	0.82a	0.78a
Korea	0.49c	0.53c	0.27b	0.26b	0.83a	0.72
Lesotho	-0.16b	0.19c	0.10c	-0.78	0.10b	0b
Madagascar	0.45c	0.09b	0.10b	0.52	0.22b	0.29b
Malawi	0.75a	0.50b	0.65a	0.64a	0.31b	0.53a
Malaysia	0.54	0.19b	0.14b	0.82a	0.27b	0.25b
Mali	0.30c	0.11c	0.11c	0.24b	0.12b	0.11b
Malta	0.30c	0.54c	0.54c	0.11c	0.13b	0.10b
Mauritania	0.44c	0.58c	0.57c	0.25b	0.39b	0.47c
Mauritius	0.59c	0.47c	0.46c	0.60c	0.45c	0.45c
Mexico	0.28c	0.30c	0.37c	0.20b	0.01b	0.03b
Morocco	0.59a	0.48c	0.47c	0.48	0.36b	0.35b
Nepal	0.89a	0.48c	0.55c	0.94a	0.39c	0.51c
Niger	0.91a	0.84a	0.89a	0.69a	0.91a	0.74a
Nigeria	0.99a	0.67c	0.73c	1.20a	0.65a	0.74a
Pakistan	0.80a	0.11b	0.26c	1.07a	0.04b	0.10b
Papua New Guinea	-0.64c	-0.27b	-0.34c	-0.39b	-0.26b	-0.21b
Paraguay	0.24b	-0.09b	-0.04b	0.60	-0.66b	-0.56b
Peru	0.70a	0.40c	0.47c	0.53	0.18b	0.30b
Philippines	1.16a	0.63c	0.72c	1.04a	0.49c	0.67a
Rwanda	0.60c	0.42c	0.57c	1.06a	-0.41	0.37
Senegal	0.50c	0.16b	0.20c	0.56a	-0.11b	-0.04b
Sierra Leone	-0.10c	0.02b	-0.01b	-0.10b	-0.02b	-0.01b
Thailand	1.13a	0.56c	0.72a	-0.52	-0.11	-0.30
Togo	0.36b	-0.02b	0.03b	0.33	0.07b	0.22b
Tunisia	1. 2a	0.42c	0.53c	1.29a	0.44	0.48c
Turkey	0.79a	0.51c	0.52c	1.01a	0.55	0.45
Uganda	0.14b	-0.03b	0.05b	0.33c	0.49	0.32b
Uruguay	0.79a	0.16b	0.18b	0.58	0.14b	0.20b
Venezuela	1.70c	1.18a	1.29a	1.67c	1.53a	1.59a
Zambia	0.69c	0.09b	0.22b	0.61a	0.42	0.71
Zimbabwe	0.69c	0.54c	0.59c	1.72		

a = Different from zero at the 5 percent level.
b = Different from one at the 5 percent level.
c = Different from both zero and one at the 5 percent level.

information content.

3. Arbitrage conditions

Direct tests of arbitrage conditions have the advantage of avoiding the use of suspect macro data, in addition to not being subject to some of the methodological problems with saving-investment correlations discussed in Section III. Accordingly, in this section I construct tests of uncovered interest parity for a large group of developing countries. Uncovered, rather than covered, parity is tested because very few forward markets exist for the currencies of developing countries. Even uncovered parity tests are difficult to conduct for very many such countries, because time series observations on interest rates of adequate length are often not available. The country sample was determined by the availability of monthly data on interest rates payable to private savers during the period January 1985 to December 1990.[22] These tended to be either short-term (0 to 6-month) deposit rates or 6-month Treasury bill rates. The countries in the sample, and the interest rate chosen for each, are listed in Table 5.

The tests were based on the behavior of the "risk premium" -- i.e., the difference between the domestic interest rate and the relevant exchange rate-corrected ex post foreign interest rate.[23] The use of ex post exchange rates is required, as usual, because the appropriate ex ante expectations of future exchange rates are unobservable. As indicated in Section III, however, if expectations are formed rationally, uncovered interest parity nevertheless imposes some restrictions on the data that can be tested. Among these are that the mean value of the "country premium" should be zero, and that deviations from the mean should be serially uncorrelated. These propositions are tested in columns 3 and 5 of Table 5. Column 3 lists the mean value of the country premium (deviation from UIP) for each country, with an asterisk indicating cases in which the mean is statistically different from zero at the 95 percent confidence level. Of the 48 countries in the sample, 32 exhibited mean deviations that were different from

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[22] The data are taken from the IMF's International Financial Statistics. The restriction that interest rates apply to assets available to private savers ruled out the inclusion of several countries for which only discount rate data were available.

[23] The "foreign" interest rate was taken to be the relevant US interest rate in each case. The rate on US three-month certificates of deposit was used when the domestic rate was a short-term deposit rate, and the US six-month Treasury bill rate was used when the domestic rate was a Treasury bill rate. In all cases, the exchange rate was the period-average market-based exchange rate against the US dollar.

Table 6 Deviations From Uncovered Parity in Developing Countries

Table 6 Deviations From Uncovered Parity in Developing Countries
(in percent)

Country	Interest Rate	Mean Deviation	Standard Error	Q(6)	MAD as Percent of UIP Total	1st Half	2nd Half
Argentina	Deposit rate	-66234	61513	6.17	1.15	0.00	2.30a
Bhutan	Deposit rate	-8.17a	1.42	72.32	0.76	0.52	10.01a
Botswana	Deposit rate	-7.4	4.98	54.34	2	2.62	1.37a
Brazil	Treasury bill rate	-1166	374.56	89.75	0.87	0.12	1.63a
Cameroon	Deposit rate	9.11a	2.67	46.46	-11.82	-12.42	-11.23
Cent. Af. Rep.	Deposit rate	9.07a	2.66	46.04	-11.77	-12.42	-11.13
Chad	Deposit rate	8.49a	2.7	48.15	-11.27	-11.51	-11.02
Chile	Deposit rate	-1.14	2.43	45.1	0.5	0.50	0.49
Colombia	Deposit rate	-13.79a	1.48	105.8	0.34	0.39	0.28
Congo	Deposit rate	9.60a	2.67	46.4	-11.95	-11.78	-11.11
Costa Rica	Deposit rate	-5.77a	1.05	88.76	0.29	0.24	0.33
Cyprus	Deposit rate	4.25a	2.04	36.44	9.49	9.93	9.05
Ecuador	Deposit rate	-70.25a	19.36	29.82	0.8	0.83	0.76
Egypt	Deposit rate	-67.23a	29.83	32.32	0.94	0.05	1.83a
El Salvador	Deposit rate	-72.82a	36.4	27.86	0.97	1.42	0.52
Eq. Guinea	Deposit rate	8.81a	2.7	48.15	-11.87	-12.67	-11.07
Ethiopia	Deposit rate	-4.65a	0.14	83.25	0.60	0.51	0.70
Gabon	Deposit rate	5.96a	2.8	44.29	-10.84	-11.49	-10.31
Gambia	Max. deposit rate	-41.94	23.57	21.60	1.28	2.04	0.51
Ghana	Treasury bill rate	-48.13a	7.16	65.76	0.8	1.20	0.40a
Guatemala	Max. deposit rate	-199.84	104.73	31.05	0.97	1.76	0.18
Honduras	Deposit rate	-63.65	36.28	29.99	0.92	0.04	1.80
Indonesia	Deposit rate	-6.10	4.16	80.50	1.00	0.95	1.04
Israel	Treasury bill rate	16.73	10.39	37.54	1.04	1.78	0.31a
Jamaica	Treasury bill rate	6.03a	2.04	132.62	1.12	1.15	1.11
Kenya	Max. deposit rate	4.26a	1.73	53.01	0.79	0.81	0.77
Korea	Deposit rate	0.76	2.22	203.72	1.00	0.91	1.09a
Lesotho	Treasury bill rate	-10.12a	3.81	52.21	1.44	1.81	1.08a
Malawi	Treasury bill rate	8.85a	1.83	132.38	-18.26	-24.32	-18.21a
Malaysia	Deposit rate	-4.29a	1.09	60.94	0.79	0.81	0.77
Mali	Deposit rate	7.25a	2.69	46.44	-11.27	-12.42	-10.12
Mauritius	Deposit rate	2.78	2.26	43.22	2.01	1.84	2.17
Mexico	Treasury bill rate	-17.30a	8.1	138.61	0.61	0.77	0.44a
Nepal	Treasury bill rate	-12.42a	1.79	76.48	0.78	0.74	0.83
Nigeria	Deposit rate	-333.75	194.6	11.84	1	1.83	0.16
Philippines	Treasury bill rate	3.56a	1.37	27.31	0.59	0.71	0.48
Rwanda	Deposit rate	4.41a	1.66	41.45	1.65	2.23	1.07a
Senegal	Deposit rate	7.79a	2.7	47.14	-11.57	-11.80	-11.34
Seychelles	Treasury bill rate	12.29a	1.24	91.89	11.54	15.24	7.84
Sierra Leone	Treasury bill rate	-383.25a	128.12	65.97	1	1.72	0.31a
Singapore	Deposit rate	-0.20	1.06	50.94	1.83	1.69	1.97
South Africa	Treasury bill rate	-3.24	3.76	52.49	1.42	1.86	0.97a
Sri Lanka	Treasury bill rate	-3.67a	1.27	84.6	0.40	0.19	0.60a
Thailand	Deposit rate	4.14a	0.7	37.9	0.94	1.11	0.77a
Trinidad & Tobago	Treasury bill rate	-18.64a	4.82	80.45	0.81	1.18	0.44a
Turkey	Deposit rate	-4.62	3.72	83.25	0.45	0.34	0.57a
Uruguay	Deposit rate	-3.54	2.59	61.13	0.19	0.19	0.18
Venezuela	Deposit rate	-286.84a	119.94	31.09	0.97	0.45	1.49

a= Different From zero at the 5 percent level.

zero during this period. Moreover, in all but one case (the rather extreme one of Argentina), Q tests indicate with a very high degree of confidence that deviations from UIP are serially correlated. Thus, leaving Argentina aside, at least one of the predictions of the joint hypothesis of UIP, rational expectations, and weak market efficiency can be rejected in every case.

To facilitate comparisons across countries, I have computed for each country the ratio of its mean absolute deviation from UIP (that is, the mean over the sample period of the absolute value of the country premium observed each month) to the mean of the exchange rate-corrected foreign interest rate. Since the latter indicates what the domestic interest rate would have been if ex post UIP had held exactly during each month of the sample period, this statistic measures how far the domestic interest rate deviated on average from what would have been observed under strong financial integration. This ratio is reported in the sixth column of Table 5. Evidently the countries in the sample are divided into two groups: the CFA Franc countries of West Africa and everyone else. The former (consisting in this sample of Cameroon, the Central African Republic, Chad, the Congo, Equatorial Guinea, Gabon, Mali, and Senegal) exhibit large and negative values of this ratio. The reason is that the appreciation of the French Franc against the US dollar during this period made the ex post external interest rate take on negative values averaging close to zero for these countries. The vast majority of the remaining countries exhibit average absolute deviations up to twice the magnitude of the UIP interest rate. By this measure, countries such as Uruguay, Costa Rica, Colombia, Sri Lanka, Chile, and Mexico are characterized by a high degree of capital mobility, in the sense that their domestic interest rates show relatively small deviations from their UIP values, while Cyprus, Mauritius, and Seychelles are at the opposite extreme of very low capital mobility.

To assess whether comparisons of this type provide any evidence of an increase in the degree of integration with world financial markets among these countries in recent years, the sample period was divided in hlf for each country and mean absolute deviations were calculated separately for each half of the period. The results are reported in the last two columns of Table 5. In 11 of the 48 countries, there was a statistically significant decline in the mean absolute deviation during the second half of the sample. Among the larger countries in this group were Israel and Mexico. On the other hand, there were seven cases in which the mean absolute deviation increased in the second half of the sample, including in Argentina, Brazil, Egypt, Korea, and Turkey. Overall, then, there is little evidence of widespread increases in financial integration here, though several countries may indeed have evolved in this direction.

There are at least two reasons to view these results with caution, however. First, the peso problem may be endemic in this

data set. The majority of the countries in the sample maintained predetermined exchange rates during the sample period, and we cannot rule out the possibility that ex post deviations from UIP reflected expected devaluations that did not come to pass or, for that matter, surprise devaluations, particularly since several countries in the sample did experience large discrete devaluations during this time. Second, in many cases the interest rates used for these calculations do not reflect market-determined rates, but rather the administered rates characteristic of a repressed financial system. Frankel (1991) has argued that this problem does not matter, because the ability to sustain domestic interest rates at levels that differ from their international counterparts is precisely what we mean by imperfect capital mobility. This argument is not convincing, however, for a number of reasons:

a. Though the interest rates we observe (i.e., those in the formal financial system) may indeed deviate substantially, as do many of those in the present sample, from their foreign counterparts, unobserved market-determined domestic interest rates, such as those in informal financial markets, may be tied much more closely to external rates. To the extent that the latter represent the marginal cost of funds in the domestic economy, the policy environment may be more closely characterized as one with high capital mobility in this case than one with capital immobility.

b. In the case of deposit interest rates, the prevalence of domestic interest rates substantially different from foreign ones may not reflect the absence of arbitrage, but rather imperfect substitutability arising from the liquidity services rendered by claims on domestic banks.

c. For Treasury bill rates, reported interest rates may not in fact reflect rates of return on assets that are willingly held, but rather the administered interest rates paid on instruments that financial institutions are required to hold in order to satisfy legal "liquidity" requirements.

The upshot is that the use of interest rates that are not market determined raises an important caveat in the interpretation of these results. While a finding that reported domestic interest rates move closely with foreign rates may indeed suggest a high degree of capital mobility, the opposite finding may simply indicate that financial repression is high, and that a closer examination of the behavior of domestic market-determined interest rates is required.

4. Euler equation tests

As indicated in Section III, Euler equation tests may provide the most direct tests of financial integration, and they avoid some of the conceptual difficulties associated with both tests of

arbitrage conditions and saving-investment correlations. In this section, I therefore implement a set of Euler equation tests, once again for the largest group of developing countries for which I was able to obtain data. In this case, the data required are time series on real per capita private consumption, national price levels, and exchange rates. Although the first of these is often a binding constraint in developing countries, the Summers-Heston (1988) data set provides the relevant series (in annual form) for many such countries over the period 1960-85. Thus the variable n_t used by Obstfeld (1986), as defined in Section III, was constructed for the 60 developing countries for which at least 15 years of data were available, using Summers-Heston data for real per capita private consumption as well as for the nominal exchange rate against the US dollar, and IFS data for the consumer price index in each of the developing countries. n_t was constructed with the United States as the domestic country and each of the developing countries in the sample in turn as the foreign country. Two alternatives were chosen for the parameter a (the inverse of the intertemporal elasticity of substitution): 2 and 1. These correspond to the values estimated by Obstfeld for the US and Japan, respectively. As explained in Section III, the procedure involves determining whether variables contained in the information set available prior to time t can help to predict n_t.

The results are presented in Table 6. Columns 4 and 5 of this table report the probability values for the likelihood-ratio test of exclusion restrictions on the constant and a single lagged value of n_t (column 4), as well as the constant and two lagged values of n_t (column 5), for the case a=2. The corresponding tests for a=1 are reported in columns 7 and 8. Failure to reject the null hypothesis embodying the exclusion restrictions is consistent with perfect capital mobility -- i.e., complete financial integration. Columns 6 and 9 indicate rejection if it occurs with <u>either</u> one or two lags. No additional lags were tried because of the scarcity of degrees of freedom.

The outcomes of these tests are quite similar to those of the saving-investment correlations reported in Tables 3 and 4, in the sense that for the large majority of countries results would seem to be consistent with a high degree of capital mobility. Specifically, the null is rejected in only 25 of the 60 countries tested with a=2, and in only 17 countries with a=1. With the single exception of Singapore, every case of rejection with a=1 was also a rejection with a=2. As in the case of saving-investment correlations, however, the interpretation of these results is complicated by poor data and few degrees of freedom. Because the null is consistent with a high degree of capital mobility, it is unclear whether a failure to reject reflects poor data or substantial financial integration. Moreover, in this case, as well as in the Feldstein-Horioka case, the data in question are developing-country macro data.

Table 6 Euler-Equation Estimates of Capital Mobility

Country	Sample	Quality	P-value: a = 2			P-value: a = 1		
			1 lag	2 lags	Reject ?	1 lag	2 lags	Reject?
Bangladesh	1961-84	C	0.37	0.03	Yes	0.39	0.02	Yes
Bolivia	1961-85	B	0.24	0.44	No	0.44	0.67	No
Burundi	1967-84	D	0.64	0.23	No	0.89	0.97	No
Cameroon	1970-84	C	0.84	0.12	No	0.59	0.9	No
Chile	1961-84	C	0.39	0.56	No	0.6	0.7	No
Colombia	1961-84	B	0.47	0.6	No	0.39	0.56	No
Congo	1961-84	D	0.08	0.13	No	0.32	0.56	No
Costa Rica	1961-84	B	0.14	0.01	Yes	0.28	0.01	Yes
Cote d'Ivoire	1962-84	C	0.16	0.16	No	0.18	0.25	No
Cyprus	1961-84	B	0.7	0.49	No	0.65	0.46	No
Dominican Rep.	1961-84	C	0.9	0.92	No	0.75	0.9	No
Egypt	1961-84	D	0.88	0.54	No	0.99	0.75	No
El Salvador	1961-84	B	0	0	Yes	0.01	0	Yes
Ethiopia	1967-84	C	0.03	0.12	Yes	0.26	0.57	No
Gabon	1964-84	C	0.84	0.78	No	0.97	0.67	No
Gambia	1963-84	D	0.49	0.79	No	0.48	0.71	No
Ghana	1966-84	D	0.01	0.03	Yes	0.01	0.02	Yes
Guatemala	1961-84	B	0	0	Yes	0	0	Yes
Guyana	1961-84	C	0.42	0.44	No	0.35	0.2	No
Haiti	1961-84	C	0.16	0.29	No	0.56	0.61	No
Honduras	1961-84	C	0.02	0.02	Yes	0.02	0.04	Yes
India	1961-84	B	0.01	0.16	Yes	0.04	0.02	Yes
Iran	1961-84	C	0.02	0.04	Yes	0.01	0.02	Yes
Israel	1961-84	A	0.25	0.77	No	0.14	0.58	No
Jamaica	1961-84	C	0.23	0.18	No	0.3	0.18	No
Kenya	1961-84	B	0.18	0.01	Yes	0.08	0	Yes
Korea	1968-84	B	0.15	0.31	No	0.46	0.76	No
Liberia	1967-84	D	0.1	0.29	No	0.21	0.45	No
Madagascar	1966-84	C	0.03	0.04	Yes	0.16	0.28	No
Malaysia	1961-84	B	0.16	0	Yes	0.19	0.16	No
Mauritius	1965-84	D	0.5	0.62	Yes	0.48	0.54	No
Mexico	1961-84	B	0.38	0.01	Yes	0.62	0.03	Yes
Morocco	1961-84	C	0.01	0.08	Yes	0.04	0.14	Yes
Myanmar	1961-84	C	0.72	0.81	No	0.58	0.38	No
Nepal	1966-84	D	0.03	0.39	Yes	0.05	0.01	Yes
Niger	1965-84	D	0.08	0.02	Yes	0.69	0.63	No
Nigeria	1961-84	C	0.11	0.24	No	0.27	0.4	No
Pakistan	1961-84	B	0.18	0.32	No	0.2	0.32	No
Panama	1961-84	B	0.48	0.42	No	0.46	0.41	No
Paraguay	1961-84	C	0.02	0.04	Yes	0.03	0.04	Yes
Philippines	1961-84	A	0.61	0.01	Yes	0.53	0.9	No
Rwanda	1968-84	D	0.99	0.98	No	0.49	0.64	No
Saudi Arabia	1965-84	C	0	0	Yes	0	0	Yes
Senegal	1969-84	C	0.34	0.33	No	0.3	0.5	No
Sierra Leone	1961-84	D	0.02	0.05	Yes	0.23	0.23	No
Singapore	1962-84	C	0.11	0.27	No	0.04	0.02	Yes
Somalia	1962-84	D	0.07	0.15	No	0.36	0.63	No
South Africa	1961-84	B	0.13	0.18	No	0.09	0.07	No
Sri Lanka	1961-84	B	0.31	0.03	Yes	0.12	0.17	No
Sudan	1961-84	D	0.09	0.09	No	0.2	0.25	No
Swaziland	1967-84	D	0.99	0.36	No	0.9	0.39	No
Tanzania	1967-84	C	0.97	0.2	No	0.52	0.14	No
Thailand	1961-84	C	0.8	0.96	No	0.63	0.83	No
Togo	1969-84	D	0.09	0.14	No	0.23	0.49	No
Tunisia	1961-84	C	0.04	0.04	Yes	0	0.02	Yes
Turkey	1962-84	B	0.55	0.24	No	0.61	0.73	No
Venezuela	1961-84	B	0.17	0.4	Yes	0.24	0.5	No
Zaire	1966-84	D	0.29	0.33	No	0.64	0.57	No
Zambia	1962-84	B	0.01	0.04	Yes	0.01	0.01	Yes
Zimbabwe	1966-84	C	0.1	0.21	No	0.15	0.28	No

Additional light can be shed on this issue in the case of Euler-equation tests, however, because Summers and Heston provide an indicator of the relative quality of their data across countries. This data "grade" is reported in column 3 of Table 6, with quality deteriorating from A to D. The incidence of rejection for grades A-C was 20 out of 44 countries, whereas for countries graded D it was only 5 of 16 with a=2. For a=1, only 2 of 16 countries with grade D rejected the null, while for those graded C and higher about a third (15 of 44) involved rejections. This suggests a clear association between poor data quality and failure to reject, and it implies that Euler equation tests using annual data for large groups of developing countries can in many cases provide only weak evidence on the issue of financial integration.

VI. Summary and Conclusions

As pointed out at the outset, an economy's degree of financial integration with the rest of the world is a key determinant of many of its most important macroeconomic properties. For the vast majority of developing countries, however, little is known about the nature of the links between domestic and external financial markets. As a result, conflicting assumptions are often made about this important feature of developing economies in both analytical and policy work. The question that has been posed here is whether the data impose any restrictions on such assumptions. This issue has been approached both by examining previous work and by undertaking, for the first time, a systematic application of existing approaches to the measurement of capital mobility to large groups of developing countries.

Unfortunately, a number of complicating factors are encountered in attempting to answer this question, which are both conceptual and empirical. Conceptually, there are two types of complicating factors: First, there is no single widely-accepted empirical measure of the degree of an economy's financial integration with the rest of the world. This problem arises precisely because of the large number of implications that follow from financial integration in the strong sense. Since tests of financial integration essentially examine whether the data are consistent with these implications, each such implication provides a separate test. Second, each of the existing empirical tests presents problems of interpretation. Such tests are based on the magnitude of gross capital flows, the applicability of arbitrage conditions, the scope for sterilization, the strength of saving-investment correlations, and the cross-country uniformity of Euler equation relationships. Perhaps the most widely used of these have been tests of arbitrage conditions and saving-investment correlations. Yet the former suffer from the need to identify comparable assets across countries, to make ancillary assumptions about unobservable expectations and agents' information sets

(resulting in tests of joint hypotheses), and from the "peso problem". Moreover, the policy implications of rejections of arbitrage conditions depend on the reasons for rejection, and this has proven to be a difficult question to resolve in the industrial-country context. The latter, on the other hand, are contaminated by a host of factors that could cause saving and investment to move together even under perfect capital mobility. Tests of restrictions implied by Euler equations, a more promising recent approach that avoids both of these types of problems, require very strong restrictions on consumer behavior across countries for their implementation.

Empirically, developing-country data provide a serious challenge which compounds these conceptual problems. The main difficulties are that the national income accounting data that underlie both saving-investment correlations and tests based on Euler equations tend to be of poor quality. The resulting errors-in-variables problem makes it difficult to reject null hypotheses consistent with high capital mobility. On the other hand, reported interest-rate data often do not refer to market-determined rates. Arbitrage conditions may therefore not tend to hold for observed interest rates, but may well hold for "informal" rates that represent the true cost of funds in the economy. This could lead to a rejection of high capital mobility when it indeed holds. The central difficulty is that these data problems operate in opposite directions. Poor macro data will yield results consistent with a high degree of financial integration when saving-investment correlations and Euler equation tests are applied, while poor interest-rate data will cause tests of arbitrage conditions to support a finding of low financial integration.

In view of the direction of the biases just mentioned, the juxtaposition of several tests may be the most judicious manner to formulate at least a first-pass impression of the extent to which large groups of individual developing countries have been integrated with world financial markets in recent times. This was attempted in Section V. The results of this section are best presented by summarizing what this evidence has to say on a country-by-country basis. For the 99 countries contained in the various samples examined in Section V, the weight of the evidence in each case is summarized in an appendix. Of this group, a majority provided enough evidence as to permit at least a crude subjective characterization of their degree of integration with world financial market during the period considered here. In some cases, however, the tests indeed proved contradictory, as suggested above, and such cases will require further study. On the other hand, alternative tests were in broad agreement for a larger group of countries.

For such countries, this characterization is provided in Table 7, where the degree of financial integration with the rest of the world of 57 individual developing countries is characterized as

"High", "Intermediate", or "Low". An important finding of this paper, consistent with a growing body of empirical work, is that a large number of developing countries can be described as financially open. This characterization would apply to the countries exhibiting a high or intermediate degree of financial integration in Table 7. Of the 57 countries classified in Table 7, in only 18 cases did the data fail to generate convincing evidence of financial openness, and for some of these countries other forms of evidence (e.g., capital flight from Venezuela) indicate that financial autarky is not an apt description of the nature of their relationship with world financial markets. Specific policy implications for individual countries will have to await more careful country-specific work to yield more refined measures of the degree of financial integration in specific cases. Nonetheless, both the evidence in the existing literature and that presented here imply that, while cases of strong financial integration may be rare in the developing world, the majority of developing countries must be regarded, for both policy and analytical work, as <u>de facto</u> financially open.

Table 7 Classification of Countries By Degree of Financial Integration

HIGH	INTERMEDIATE	LOW
Bolivia	Botswana	Bangladesh
Chile	Burundi	El Salvador
Congo	Cameroon	Ethiopia
Cote d' Ivoire	Colombia	Ghana
Dominican Rep.	Costa Rica	Honduras
Gabon	Cyprus	India
Gambia	Ecuador	Kenya
Israel	Egypt	Mauritius
Jamaica	Guatemala	Morocco
Panama	Haiti	Nepal
Senegal	Korea	Niger
Singapore	Lesotho	Paraguay
Togo	Madagascar	Philippines
Uruguay	Malawi	Rwanda
	Malaysia	South Africa
	Mauritania	Sri Lanka
	Mexico	Tunisia
	Pakistan	Venezuela
	Papua New Guinea	
	Seychelles	
	Sierra leone	
	Thailand	
	Trinidad & Tobago	
	Turkey	
	Uganda	

Source: See Appendix

APPENDIX

The following is a country-by country summary of the tests performed in the text, for all countries contained in any of the samples. In addition, each country has been classified subjectively into one of three categories of financial integration (High, Intermediate, or Low) during the eighties according to these measures. Countries for which information was available for only one measure of integration (typically the gross-flow ratio measure, or GFR) were left unclassified, as were those for which the various measures were judged too contradictory to permit even a rough classification. The group classifications reported below for the GFR measure refer to the ranges reported in the text -- i.e., Group 1 exhibited a GFR greater than 20 percent, that for Group 2 was less than 20 percent but greater than 15 percent, Group 3 was below 15 but above 10 percent, the modal Group 4 represented the range below 10 but above 5 percent, and finally Group 5 included all countries with GFR ratios below 5 percent. No systematic rules were imposed on the classification procedure, except that the presumption was against classification in the High range if the preferred Euler equation test rejected integration. On the other hand, little weight was given to this test when it failed to reject integration with poor data (rated D by Summers and Heston).

AFRICA

1. Algeria - Unclassified
   GFR is in Group 4; FH test yields b not different from zero or one.

2. Benin - Unclassified
   The coefficient b in the FH test is statistically different from both 0 and 1; no other information.

3. Botswana - Intermediate
   GFR is in Group 3, and the mean deviation from UIP is not different from zero, though its mean absolute deviation is fairly high.

4. Burkina Faso - Unclassified
   The only information is from GFR, which is fairly low (Group 5).

5. Burundi - Intermediate
   The FH coefficient b is different from 0 and 1; the Euler equation test fails to reject financial integration, but the data is poor (D).

6. Cameroon - Intermediate
   The FH coefficient b is different from 0 and 1 and the Euler test fails to reject integration with data quality C.

7. Cape Verde - Unclassified
   The only information is from GFR (Group 4).

8. Central African Republic - Unclassified
   GFR is in Group 4; the FH coefficient b is not different from 0 or 1.

9. Chad - Unclassified
   The only information is from GFR (Group 4).

10. Congo - High
    GFR is in Group 1; the FH test puts b in the intermediate range; the Euler test fails to reject integration (though with D-quality data).

11. Cote d'Ivoire - High
    Group 2 in the GFR test; the FH coefficient b in the intermediate range; the Euler test fails to reject integration with C-quality data.

12. Ethiopia - Low
    Lowest group in GFR test; the UIP differential is statistically different from zero, though not large; Euler test rejects integration.

13. Gabon - High
    Group 2 in the GFR test; the FH coefficient b is in the intermediate range; the Euler test fails to reject integration with C-quality data.

14. Gambia - High
    Group 2 in GFR test; the FH test rejects b=1, but not b=0; the UIP differential is not different from 0, and the Euler test fails to reject integration (data quality is D).

15. Ghana - Low
    Group 4 in GFR test; FH test rejects b=0 and fails to reject b=1; UIP differential is different from zero; the Euler test rejects integration.

16. Guinea-Bisseau - Unclassified
    The only information is from the GFR test (Group 2).

17. Kenya - Low
    Group 4 in the GFR test; the FH coefficient b is different from 0 but not different from 1; the UIP differential is different from 0; the Euler test rejects integration.

18. Liberia - Unclassified
    Only the Euler test is available (fails to reject with poor data).

19. Lesotho - Intermediate
Group 2 in GFR test, and the FH test rejects b=1, but fails to reject b=0; however, the UIP differential is different from zero and high.

20. Madagascar - Intermediate
Group 3 in GFR test; the FH test fails to reject b=0, but rejects b=1; however, the Euler test rejects integration.

21. Malawi - Intermediate
The FH test rejects b=0, but the estimate of b is relatively low (0.53); the UIP differential is different from 0.

22. Mali - Unclassified
Group 4 in GFR test, but the FH test rejects b=1 while failing to reject b=0.

23. Mauritania - Intermediate
Group 2 in GFR test and the FH coefficient b is in the intermediate range.

24. Mauritius - Low
Though the FH coefficient b is in the intermediate range, the GFR measure puts this country in Group 4; though the UIP differential is not different from zero, it is very high on average; the Euler test rejects integration.

25. Morocco - Low
Group 4 in GFR test; though the FH test rejects b=1 and fails to reject b=0, the Euler test rejects integration.

26. Niger - Low
Group 4 in GFR test; the FH test rejects b=0 but fails to reject b=1; the Euler test rejects integration.

27. Rwanda - Low
Group 5 in GFR test; the FH coefficient estimate is imprecise; the UIP differential is different from 0 and high; the Euler test fails to reject integration, but the data is poor.

28. Senegal - High
GFR is in Group 3; the FH rejects b=1, but not b=0; the Euler test fails to reject integration with C-quality data.

29. Seychelles - Intermediate
GFR is in Group 3, but the UIP differential is different from 0 and very high.

30. Sierra Leone - Intermediate
GFR is in Group 3 and the FH test rejects b=1 while failing to reject b=1, but the UIP differential is different from 0 and the Euler test rejects integration.

31. Somalia - Unclassified
GFR is in Group 3; the Euler test fails to reject integration, but with D-quality data.

32. South Africa - Low
GFR is in Group 5; though the UIP differential not different from 0, it is high on average; the Euler test fails to reject integration, but the data is poor.

33. Sudan - Unclassified
GFR is in Group 5; the Euler test fails to reject integration, but with D-quality data.

34. Swaziland - Unclassified
GFR is in Group 3: the Euler test fails to reject integration, but with D-quality data.

35. Tanzania - Unclassified
GFR is in Group 4; the Euler test fails to reject integration with D-quality data.

36. Togo - High
GFR is in Group 2, the FH test rejects b=1 while failing to reject b=0, and the Euler test also fails to reject integration, though the data is poor.

37. Tunisia - Low
GFR is in Group 4; the FH coefficient b is in the intermediate range, but the Euler test rejects integration.

38. Uganda - Intermediate
GFR is in Group 3; the FH coefficent test rejects b=0, but not b=1.

39. Zaire - Unclassified
GFR is in Group 4, but the Euler test fails to reject integration, though with D-quality data.

40. Zambia - Unclassified
GFR is in Group 2, but the Euler test rejects integration.

41. Zimbabwe - Unclassified
The Euler test fails to reject integration, but with poor data.

ASIA

42. Bangladesh - Low
GFR is in Group 5 and the Euler test rejects integration.

43. Bhutan - Unclassified
The UIP differential is different from zero, but not large.

44. Fiji - Unclassified
GFR is in Group 4, but the FH test rejects b=1 while failing to reject b=0.

45. India - Low
GFR is in Group 5; the FH test rejects b=0 and the coefficient b is high; the Euler test rejects integration.

46. Indonesia - Unclassified
GFR is in Group 5, but the UIP differential is not significantly different from zero.

47. Korea - Intermediate
GFR is in Group 4, but the UIP differential is not significantly different from zero, and the Euler test cannot reject integration even with B-quality data.

48. Malaysia - Intermediate
The FH test rejects b=1 and b is very low (0.25), but GFR is in Group 4, the UIP differential differs from zero, and the Euler test rejects integration.

49. Myanmar - Unclassified
The Euler test cannot reject integration with C-quality data.

50. Nepal - Low
The FH test put b in the intermediate range; the UIP differential is different from zero; the Euler test rejects integration.

51. Pakistan - Intermediate
GFR is in Group 5, but the FH test rejects b=1 while not rejecting b=0, and Euler test cannot reject integration even with B-quality data.

52. Papua New Guinea - Intermediate
GFR is in Group 3 and FH test rejects b=1, but not b=0.

53. Philippines - Low
GFR is in Group 4, the FH test rejects b=0, but not b=1, and the Euler test rejects integration.

54. Singapore - High
GFR is in Group 1 and the UIP differential is not significantly different from zero, but the Euler test rejects integration.

55. Sri Lanka - Low
GFR is in Group 4; the UIP differential isdifferent from zero, though not high; the Euler test rejects integration.

56. Thailand - Intermediate

GFR is in Group 4; the UIP differential is different from zero; the Euler test fails to reject integration with C- quality data.

57. Tonga - Unclassified
GFR is in Group 5; no other information.

58. Western Samoa - Unclassified
GFR is in Group 4; no other information.

EUROPE

59. Cyprus - Intermediate
GFR is in Group 4, the UIP differential is significant and large, but the Euler test fails to reject even with B-quality data.

60. Turkey - Intermediate
GFR is in Group 4, but the UIP differential is not different from 0 and Euler test fails to reject integration with C-quality data.

MIDDLE EAST

61. Bahrain - Unclassified
GFR is in Group 3; no other information.

62. Egypt - Intermediate
GFR is in Group 4; the FH coefficcient b is in the intermediate range; the UIP differential is different from zero; the Euler test fails to reject with poor data.

63. Israel - High
GFR is in Group 3; the UIP differential is not different from zero; the Euler test fails to reject with A data.

64. Kuwait - Unclassified
GFR is in Group 2; no other information.

65. Lybia - Unclassifed
GFR is in Group 4; no other information.

66. Saudi Arabia - Unclassified
GFR is in Group 3, but the Euler test rejects integration.

67. Syria - Unclassified
GFR is in Group 4; no other information.

WESTERN HEMISPHERE

68. Antigua - Unclassified
GFR is in Group 1; no other information.

69. Argentina - Unclassified
The UIP differential is not different from zero; no other information.

70. Bahamas - Unclassified
GFR is in Group 5; no other information.

71. Barbados - Unclassified
GFR is in Group 4; no other information.

72. Bolivia - High
GFR is in Group 2; the Euler test fails to reject integration with B data.

73. Brazil - Unclassified
GFR is in Group 4, but the FH test rejects b=1 while not rejecting b=0.

74. Chile - High
GFR is in Group 2; the FH test rejects b=1; the UIP differential is not different from 0; the Euler test fails to reject integration with C data.

75. Colombia - Intermediate
GFR is in Group 4; the FH estimate of b is in the intermediate range; the UIP differential is different from zero, but low; the Euler test fails to reject integration with B data.

76. Costa Rica - Intermediate
GFR is in Group 1; the FH estimate of b is in the intermediate range; the UIP differential is different from zero but low; the Euler test rejects integration.

77. Dominica - Unclassified
GFR is in Group 4; no other information.

78. Dominican Republic - High
GFR is in Group 4, but the FH estimate of b is low and the Euler test fails to reject integration with C-quality data.

79. Ecuador - Intermediate
GFR is in Group 2; the FH test rejects b=1, but not b=0; the UIP differential is not different from 0.

80. El Salvador - Low
The FH test rejects b=1 with low b, but the GFR is in Group 4, UIP is different from 0, and the Euler test rejects integration.

81. Grenada - Unclassified
GFR is in Group 3; no other information.

82. Guatemala - Intermediate
The FH test rejects b=1 while failing to reject b=0, and the UIP differential is not different from 0, but GFR is in Group 4 and the Euler test rejects integration.

83. Guyana - Unclassified
The Euler test fails to reject integration with C-quality data.

84. Haiti - Intermediate
GFR is in Group 5, but the Euler test fails to reject with C-quality data.

85. Honduras -Low
GRF is in Group 3 and UIP is not different from 0, but the latter would be rejected at a slightly higher sugnificance level, the FH test rejects b=0, and the Euler test rejects integration.

86. Jamaica - High
The UIP differential differs from 0 and is relativelly high on average, but GFR is in Group 1 and the Euler test fails to reject integration with C-quality data.

87. Mexico - Intermediate
GFR is in Group 4 and the Euler test rejects integration, but the FH test rejects b=1 with very low b and, though the UIP differential differs from 0, it is low on average.

88. Nicaragua - Unclassified
GRF is in Group 1; no other information.

89. Panama - High
GRF is in Group 1; the Euler test fails to reject with B-quality data.

90. Paraguay - Low
Though the FH test rejects b=1, GFR is in Group 4 and the Euler test rejects integration.

91. Peru - Unclassified
The FH test rejects b=1; no other information.

92. Sao Tome & Principe - Unclassifed
GFR is in Group 1; no other information.

93. St. Kitts - Unclassified
GFR is in Group 2; no other information.

94. St. Lucia - Unclassified
GFR is in Group 3; no other information.

95. St. Vincent - Unclassified

GFR is in Group 4; no other information.

96. Suriname - Unclassified
GFR is in Group 5; no other information.

97. Trinidad - Intermediate
GFR is in Group 4; the UIP differential is different from zero, but not large.

98. Uruguay - High
Though GFR is in Group 4, the FH test rejects b=1, the UIP differential is not different from zero, and its mean absolute value is very small.

99. Venezuela - Low
GFR is in Group 4; the FH test rejects b=0; the UIP differential is different from zero; the Euler test rejects integration.

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